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A Monthly Educational Journal.

EDITED BY JOSEPH HUGHES.

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Wisdom is humble that he knows no more.'

COWPER—THE TASK, VI., 96, 97.

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THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

I.

IT is proposed to consider this part of our subject under three heads, all of which are connected with a departure from a proper condition of health, which may be common to all schools, and which require immediate attention on the part of those in authority. These departures may be general or particular, may happen to considerable numbers of children at one and the same time, or be personal only to one or more as they are caused by one's own or another person's act. The measures to be taken by the teachers have reference to the prevention of disease or accident, as well as to the removal of their incidence when they do arise. They separate themselves into *School Hygiene*, or measures connected with the subject of infectious disease; *School Surgery;* and a less important division, which includes simple instruction upon *Medicine*, and is connected more directly with disturbances of health, especially those which are trivial and do not require medical attendance.

School Hygiene includes a consideration of the measures requisite to prevent the admission of infectious diseases, to prevent their extension when they are unfortunately admitted, and to remove them from the precincts of the school as soon as possible after admission, so as to avoid the necessity for closing the establishment altogether.

Under the head of *School Surgery* we shall consider the accidents which more properly belong to school life; and also the emergencies which are of frequent occurrence, and which render a knowledge of the principles which ought to be followed absolutely necessary on the part of those in authority, so that no mischief may be done before the surgeon, who may have been summoned, can possibly appear upon the scene; and lastly, we have the simple principles of household medicine, which should be known to all men and women who are heads of establishments, and especially to those who have a number of young people under their care.

Nimia cura medici, which some people are supposed to require, and which uneducated people too often indulge in, does more harm than good. A knowledge without prudence, a zeal without discretion, and a theory without practice, are all bad; but they are especially so in the arena which belongs to the properly educated medical man. It follows, therefore, that nothing is put forward here which is intended to supersede the necessity for medical advice when it can be obtained, but only to provide for emergencies when no doctor is at hand, and when attention is wanted immediately, or in which it is important that the school authority should know how to act when such emergency does arise, and when action must be immediate.

These rules are based upon those which every properly educated medical practitioner will be sure to follow upon his arrival on the scene, and there will be so much time gained, either in preventing mischief from accident, in arresting the progress of infectious disorder by taking time by the forelock, and preventing altogether the necessity for further medical aid, "Prevention being better than cure" on all hands, and no body of men recognise this more fully than the honest-hearted medical practitioner.

School Hygiene.—The conduct of masters regarding infectious diseases requires more consideration than it gets at present. The difficulties which are daily arising in all parts of the country from a neglect of proper rule is such as justifies early attention to this part of our subject.

No child should be allowed to come to school who is personally suffering from any of the ordinary infectious diseases. They are Measles, Scarlet fever (or scarlatina, as it is often called), Diphtheria, Whooping-cough, Mumps, Small-pox, Chicken-pox (or glass-pox), Scald head (or ringworm), Purulent Ophthalmia, and Scabies (or itch).

If the school be a boarding-school, any child suffering from any of these diseases must be at once removed from the school, and all those who have been in contact with that particular child for the preceding twenty-four hours should be put in quarantine—that is, to be kept separated from the rest of the school. No person should be allowed to return to school after recovery from any of the above diseases until after they have been thoroughly disinfected, and after the lapse of a certain period, which should date from the termination of the fever stage. This disinfection must include a proper bathing of the whole body in some disinfecting fluid, such as a weak solution of Condy, or

water in which some chlorinated soda has been mingled. If the whole body is well sponged over with some water containing 1 per cent. of Condy or chlorinated soda, and then well scrubbed in a bath with some oatmeal, the whole of the infecting matter on the body may be rapidly removed. It is requisite to cut the hair, and then to wash the head first with the disinfecting solution, and then with some water, to which a little borax has been added; half an ounce of borax in a quart of water is a cleansing solution which will dissolve particles of epithelium, and prevent them from clinging to the hair to the danger of the child's fellows. The nails, both of fingers and toes, should be cut, and the ears washed out, and if the process of washing is repeated every day for a week there will be but little chance of danger to other children from that particular cause, provided there are no eruptions and no discharging abscesses or other sequences of the disease itself upon any part of the body; these are generally found at the alæ of the nose, behind the ears, or near to one of the orifices of the body. These should be all cured before the child is readmitted to the school.

Where possible, a medical certificate should be produced, which should state that the child is free from infective power: but if no certificate is forthcoming, a child should not be admitted into school until three weeks after recovery from measles, a month after scarlet fever, at least six weeks after diphtheria, three weeks after mumps, a month after small-pox, provided all scabs have disappeared in that time, and nearly as long for chicken-pox. No definite time can be fixed for whooping cough, and it is doubtful whether, if it be in a given neighbourhood, it can be excluded from a large school, but no child actually whooping should be allowed to stay in the school.

Ringworm or scald head arises in the majority of instances from want of washing. If such cases appear in any school, all the children should have their heads well washed with soap and water, and afterwards well sponged over with a solution of borax—an ounce to a gallon of warm water should be about the strength of the solution—whilst those children who have the disease manifestly present should be kept at a distance until the places are perfectly well. It is right, however, to state that a large number of cases which are called ringworm are not the true disease. The real ringworm is characterised by the presence of a vegetable growth in the epidermis. A microscopical fungus, styled the 'tricophyton,' produces one form of true ringworm. They are either isolated spores or jointed filaments, which attack the scalp and grow in the hairs and their sheaths, and also amongst the epidermis of the scalp and other parts of the body. There are several of these parasites which produce disease in the hairy structures. They can only be cured by plucking out the diseased hairs, cleansing the patches first with soft soap, then with solution of borax, and lastly applying equal parts of sulphurous acid and glycerine. The diseases are various forms of tinea, and are at first scarcely to be distinguished from harmless patches of tetter or simple lichen, except by the expert. The worst form of infectious ringworm is that which is styled 'tinea favosa.' It is produced by a fungus called 'achorion,' an dit is at once known by the presence of yellow, cup-shaped crusts on the scalp; it is highly infectious, very difficult to cure, and on no account should a subject of it be admitted into the society of other children. It is always a mark of badly-nourished, badly-fed constitutions, and associated with filthy habits.

Cleanliness of head is a necessary contingency in all schools, so that the chance of infection may be avoided. All large schools should have a place in which the hair should be combed and the head properly cleansed as frequently as may appear necessary. The operation should be superintended by a monitor or person appointed to see its due execution; a senior child in turn should take this duty under the control of the teacher. The brushes and combs in use must be kept clean, and each child restricted to his own articles. In elementary day schools it would be good practice to have occasional inspection drill as regards the children's heads. I am sure it is far more important to teach children the necessity for clean heads than for nine-tenths of the tasks which are done in the school hours, and yet I am not aware of a single day school in which such an inspection drill exists. It would assist the master or mistress very materially in their work by checking irritation, and will assist very much in diminishing the incidence of infection at any rate as regards diseases of the scalp.

Purulent or infectious Ophthalmia is a very troublesome disease, and when it has obtained hold in a school it is very difficult to eradicate; personal attention to each case and rigid isolation will alone effect its removal, whilst it often happens that much injury is done to eyesight in consequence. The disease which is called Scabies or Itch is not uncommon in some elementary schools; it is not usual to take much notice of it, but a child who is the subject of it ought not to be admitted into any school until he is cured. This is not a difficult matter; it can be effected in three days if the disease be vigorously attacked. It is due to a small insect somewhat like a cheese-mite, which burrows in the epidermis and lays its eggs, the hatching of which gives rise to the itching from which the disease is named. Sulphur is fatal to the insects themselves, and if used by inunction, so that the canals leading to the nests of the insect get filled with the sulphur itself, the young brood are destroyed as soon as they change their state from ova to developed acari, whilst all the insects which have been previously hatched, both male and female, are at once destroyed by contact with the sulphur.

The preceding observations apply to children who are suffering or have suffered from disease, but it may be that the child is not himself affected, but is living in a house in which some one else is suffering from infectious complaint, and that child may convey the disease to his school-fellows. No child should be allowed to attend school under these circumstances. The rule, however, may be somewhat relaxed in the case of children who have already had an attack of the same kind of disease at some anterior period, say in the preceding year, provided they are kept from all immediate contact with sick persons until the recovery and disinfection are complete. It may also be relaxed in the case of those children who, not having themselves had the disease, have not been in contact with the case and have been at once removed to an uninfected house; or if they have been in contact with the case, then a fortnight's quarantine should be established, which will clear them all from the possibility of becoming the subject of infectious complaints if they have escaped infection on that occasion. Children are frequently sent to school whilst suffering from an in

fectious disease, which had not been recognised because it is extremely mild, or in its very early stage, or, as too often happens, because the parents are careless as to other people, and won't take the trouble either to verify their suspicions or even to prevent mischief when they know that it is likely to happen. The teacher or director of every school should, therefore, give immediate personal attention to any one who may appear ill or complains of feeling unwell. Feverishness should lead him to suspect the presence of infectious disease, and if the teacher could be provided with a thermometer, such as is now in common use among medical men, he need never be in doubt upon this head. If the feverishness is combined with any kind of rash upon the skin, or with any appearance or complaint of sore throat, or with both, he need be under no difficulty as to the advisability of that child leaving the schoolhouse as soon as possible. The thermometers are provided by all the surgical instrument makers, and are of very simple construction; they have an index which registers the highest temperature. If this is placed in the axilla or armpit of the child, so that the mercury in the bulb is kept in contact with the skin at the deepest part of the axilla for five minutes, it will register the highest temperature. If this exceeds 100 (the normal being 98·5) it is evident that the child should not be at school at all, and should be sent home at once, or if it be a boarding-school, the child should be put in quarantine.

(To be continued.)

Eminent Practical Teachers.

PESTALOZZI.

BY THE REV. CANON WARBURTON, M.A.,
Her Majesty's Inspector of Training Colleges for Schoolmistresses.

JOHN HENRY PESTALOZZI* was born as long ago as 1746, but he lived to be past eighty years of age, and many of those who knew him, and some of those who were taught by him, are still alive.

Quite apart from his reputation as a teacher he was a remarkable man, and his history is well worth studying and laying to heart; there is much in it to be admired—admired perhaps, rather than imitated, much to be avoided, perhaps, rather than to be condemned. He was not a very wise, certainly not a very practical man, but he had in him something of the Divine gift of Genius,—a heaven-sent conviction that he had found a new truth, and a passionate yearning, which no difficulty could deter or failure dishearten, to turn it to account for the benefit of mankind.

His father, who had been a doctor, died when Pestalozzi was only six years old, and the boy was brought up in narrow circumstances, but still 'as a spoilt darling,' so he tells us, 'by one who was the best of mothers,' but too much absorbed in household cares to attend much to the development of her son's character. Many of the errors and weaknesses of his manhood are undoubtedly traceable to his want of masculine example and discipline as a boy; but, on the other hand, the tender affectionateness which he learned from his mother is the keynote of his life, and has coloured the whole system of education of which he was the originator.

His birth-place was Zurich, the capital of the Swiss Canton of that name,—and there he went to school. 'In all school games,' he says, 'I was the clumsiest and most helpless of all the boys, yet always trying to excel them. They used to call me "Wonderful Harry from Foolstown." They liked me for my good nature, though they were always laughing at my awkwardness and thoughtlessness about everything that did not particularly interest me. Though one of the best of the scholars, my flightiness led me to commit faults of which the worst of them were never guilty. Generally seizing with quickness and accuracy upon the essentials of the subjects taught me, I was indifferent and careless as to the form and method. At the same time that I was far behind my classmates in some parts of my work, in others I surpassed them in a remarkable degree. The wish to be acquainted with some branches of knowledge that took possession of my heart and imagination, even though I neglected the best means of acquiring them and of exercising myself in them, was strong in me to enthusiasm; and it unfortunately happened that the tone of public culture in my native town was at this time eminently calculated to foster the ambition of taking an active interest in affairs, long before one had had sufficient experience or training for such an attempt. Freedom, beneficence, self-sacrifice, and patriotism were the watchwords of our education; but the means of attaining to all this which was especially commended to us, namely, cultivation of the intellect, was left without that solid and efficient training of the practical ability which is the essential condition of its success. We imagined, whilst yet in the position of school-boys, that by a superficial school acquaintance with the great civil life of Greece and Rome, we should eminently prepare ourselves for the little civil life of a Swiss canton.'

In his holidays Pestalozzi frequently paid long visits to his uncle, the pastor of a rural village three miles from Zurich, where he became much attached to, and beloved by the country folk. A strong antagonism existed at this time in Switzerland between town and country, aristocracy and poor, and Pestalozzi took part, enthusiastically, as was his wont in everything, with the latter; and conceived a strong prejudice against the higher classes, by whom he believed his humbler neighbours to be oppressed—a prejudice which largely and, it must be added, injuriously affected both his character and his career.

He had no sooner emerged from boyhood than he fell under the influence of the famous Jean Jacques Rousseau, whose ideal scheme of liberty, with its visionary speculations on philosophic education and contempt for established scientific methods, had at this time taken hold of the imagination, and deeply tinged the ideas of the younger generation. Rousseau's educational treatise 'Emile' appeared when Pestalozzi was sixteen, and had before long run the round of all the European languages, and was regarded almost in the light of a new revelation. The young enthusiast found something which went straight to his own heart in Rousseau's fervid and tender love for humanity, in his sympathy with the sufferings of childhood, and his profound feeling of the political and social corruption of the times. No sooner had Pestalozzi read 'Emile' than the whole home and public education of the

* Pronounced Pest-a-lot-zy. He was, of course, a Swiss, but the name is of Italian origin, and in the Italian language the first of two 'z's' coming together is pronounced like a 't.'

world at all previous times and in all ranks of society appeared to him as one gigantic blunder, which could be rectified only by the realization of Rousseau's ideas.

As yet, however, he had not awakened to a consciousness of his vocation and destiny as a practical teacher of children. The first effect which the study of Rousseau produced upon his mind was to induce him to abandon the preparation which he had already begun for the clerical profession; in the hope that by devoting himself to jurisprudence he might find a career more adapted to procure for him a position in which he might exert an active influence on the social condition of his native land. One of his biographers, however, tells us that he abandoned theology, because he broke down twice in his first sermon, and found himself incapable of committing even the Lord's Prayer accurately to memory.

Among the friends of his youth who exercised an influence in the formation of his ideas and character were the celebrated Lavater, of whom we shall hear again, and a gifted youth named Bluntschli, who died of consumption at an early age. In his last moments Bluntschli sent for Pestalozzi, and said to him, 'I am dying, and when you are left to yourself you must not rush into any career which might be dangerous to you from your easy and confiding disposition. Try to find some quiet tranquil line of life, and unless you have by you a friend who will faithfully assist you, with a calm dispassionate knowledge of men and things, by no means embark in any undertaking whose failure would be disastrous for you.' Such was his friend's estimate of his character, but that no one knew its defects better than he did himself is sufficiently proved by the extract which follows from a love-letter to his betrothed, the beautiful and high-minded Anna Schulthess.

'Dearest Schulthess, those of my faults which appear to me the most important in relation to the situation which I may occupy in after-life are improvidence, flightiness, and want of presence of mind to meet unexpected emergencies. I cannot tell how far these faults may be diminished by my efforts to counteract them by calm judgment and experience. At present I have them still in such a degree that I dare not hide them from the maiden I love; they are defects, my dear one, which deserve your fullest consideration. I have other faults arising from my irritability and sensitiveness which often refuse to submit to my judgment. I very frequently let myself run into excesses in praising and blaming, in likings and dislikings. Whenever my country or my friend is unhappy, I am myself unhappy. Direct your whole attention to this weakness; there are times when the cheerfulness and tranquillity of my soul will give way under it . . . Of my great and even culpable negligence in all matters of etiquette, I need not speak; any one can see all that at the first sight of me. I also owe to you the candid confession, my dear one, that I shall always consider my duties towards my beloved partner subordinate to my duties towards my country, and that though I shall be the tenderest of husbands, nevertheless, I hold it to be my duty to be inexorable to the tears of my wife, if she shall ever attempt to restrain me by them from the performance of my duty as a citizen. My wife shall be the confidante of my heart, the sharer of all my most secret counsels; a great and honest simplicity shall reign in my house. And one thing more: My whole heart is my country's; I will risk all to alleviate the need and the misery of my countrymen. What consequences may the undertakings to which I feel myself impelled draw after them! How unequal to them am I! and how imperative is my duty to show you the possibility of the great dangers they may bring upon me!

'Decide now for yourself, whether you can join your heart to a man with these faults and these prospects in life—and be happy. I love you so dearly from my heart, that this step has cost me much. I fear to lose you, my darling, when you see me as I am. I had often thought, 'I will be silent'; but at last I have conquered myself, and I rejoice at what I have done.'

Bluntschli had scarcely been a month dead when Pestalozzi fell so dangerously ill that he was on the point of following his friend to the grave. His physician told him that he must give up all scientific study and rest his brain. His sympathy with Rousseau's anti-scientific ideas made this abandonment of methodical study only too easy. He sold his books, burned his MSS., and betook himself to a farmer of considerable reputation, named Tschiffeli, in the Canton of Bern, and sought his instruction and advice as to the best means of realising his dreams for the amelioration of the condition of the poor. It was an unfortunate selection of a counsellor. 'I came to him,' says Pestalozzi, 'a political visionary, and left him an agricultural visionary, full of enthusiasm for my gigantic schemes fresh awakened by his plans, which, though difficult of execution, and in the main impracticable, were bold and original in conception.'

Tschiffeli had become famous by his plantations of madder, and Pestalozzi's first practical essay was in the cultivation of this plant. He induced a wealthy firm, in Zurich, to become partners with him in the purchase of one hundred acres of chalky heathland for this purpose, on which he immediately proceeded to erect an Italian villa. To this house and estate he gave the name of *Neuhof, and there he settled at the age of twenty-four with his fair wife, Anna Schulthess, who had ventured, in spite of the warnings of the love-letter above quoted, to throw in her lot with his.

The madder plantation proved a failure. The Zurich firm which had advanced the money for the undertaking, withdrew it at a sacrifice rather than risk the whole in such incompetent hands. Pestalozzi now found himself thrown upon his own resources, but with extraordinary courage, or extraordinary imprudence, he determined not only to go on with his agricultural speculations, but to combine with them a school for the gratuitous education of poor children. He drew up and made public a scheme for the establishment of this institution, and his plans and principles commanded such general approbation that, in spite of a growing distrust in his practical ability, he received offers of assistance from several of the principal towns of Switzerland. The 'Neuhof Poor School' opened in 1775, with fifty scholars. It was what we should now call an industrial school, for the children were to help out their expenses by their earnings, working in summer on the farm, and in winter at weaving, spinning, and other indoor occupations. The plan was a good one, and such a school has since then many and many a time proved almost self-supporting in competent hands, but it failed in those of Pestalozzi. Discipline never existed; the children would not work while they stayed with him, and ran off when they got new clothes.

* Pronounced Noy-hofe.

the civil authorities declining to interfere. These, however, were difficulties which time and patience might have overcome. The real cause of failure lay in the fact that he tried to carry out his experiment on a scale quite disproportioned to his skill, capital, and experience. It was an undertaking which required and presupposed a thorough knowledge of manufactures, men, and business, in which, to use his own words, he 'was deficient in the same proportion as such knowledge was indispensable to him in the direction which he had given to his undertaking.' 'I who so entirely disapproved of hurrying on to the higher stages of instruction before a thorough foundation had been laid in the elementary stages, looking upon it as the fundamental error in the education of the day,—allowed myself to be carried away by illusions of the greater remunerativeness of the higher branches of industry, without knowing even remotely the means of teaching, or even of learning them,—and to commit the very faults in training up school children to spin and weave, which I so strongly reprobated and denounced, and which I considered dangerous to the domestic happiness of all classes.' There never was a more candid confession of incapacity, but still he struggled on, his noble wife assisting his endeavours,—determined to share his last crust with his children rather than turn them adrift. 'He lived like a beggar to teach beggars how men live.' He laboured night and day to raise others from the misery into which he had himself fallen. At last, however, all was spent, and, in addition to that, he became deeply involved in debt; his own small fortune and his wife's considerable one had melted away. In 1780 the Neuhof School was closed, and Pestalozzi found himself in 'his elegant country house' all but penniless, with a wife whom trouble had thrown into a lingering illness, and the wolf at the door. 'When my experiment went to wreck,' he writes, 'the blind confidence which people had reposed in me changed into just as inconsiderate a distrust. All belief in the qualifications which I really possessed was now lost, along with the belief in those which, in my self-deception, I gave myself credit for, but had not. My friends now only loved me without hope, and in the whole of the surrounding neighbourhood it was everywhere said that I was a lost man, and that nothing more could be done for me.'

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

Joint Author of 'The Field-Naturalist's Handbook.'

No. XIII.—THE MONKEY TRIBE.

PART I.

THE grotesque resemblance borne by the larger apes towards the human form has given rise to various conjectures regarding the relationship between man and the monkeys. Without, however, touching upon these speculations, with which we need not concern ourselves, we will examine the chief points of structure in which the two beings resemble, and also those in which they differ from, one another.

As a type of the tribe we will take the Gorilla *(Troglodytes gorilla)*, as standing first in the family, and compare the respective skeletons of that animal and of a human being.

No second glance is needed to see the wonderful difference which exists between the bony framework of the man and that of the beast. The clumsy, brutal head of the ape, with its low, receding forehead, protruding cheek-bones, and massive jaws, is quite unlike the rounded skull of the man, with its upright forehead and small jawbone. Then the almost total absence of neck; the long, ungainly arms, with their enormous hands; the short, bowed legs, all insufficient to support the body upright; and the peculiar structure of the feet, suffice to prove, even without entering into further details, the immeasurable distance which separates the two beings.

As we proceed in our examination, this conviction is still more strongly forced upon us, every part of the frame bearing witness to the nature and habits of the beast, as opposed to those of the man.

Let us now examine the structure a little more closely.

We notice, in the first place, the great size and strength of almost every bone in the body, which at once informs us that the muscular power is proportionately developed.

This is the case to a singular degree in all the larger apes, the strength, more especially of the arms, being perfectly astonishing. M. Du Chaillu tells us that a gorilla has been seen to bend a gun-barrel double by means of the hands alone, grasping the weapon in the huge paws, and bending it without apparent exertion. He also remarks that, unlike most wild animals, the gorilla possesses scarcely more tenacity of life than man. The surest mode of killing this ape is, when it has turned to bay, to allow it to approach within two or three yards, and then to aim at the centre of its breast. It succumbs at once to the shot, and falls dead on its face, almost without a struggle.

The hinder limbs, too, are powerful in their way, the grasp of the foot, in particular, being very great. But when called upon to sustain the weight of the animal upon level ground, they are of comparatively little use.

This is not so much owing to the want of the requisite strength, as to the structure of the opposite extremities of the body, namely, the head and the hinder paws. Both of these are formed in such a manner that an upright carriage is impossible, the animal, even when at rest, being quite unable to assume a perfectly erect attitude.

When the structure of the head and feet is examined, this inability is easily accounted for.

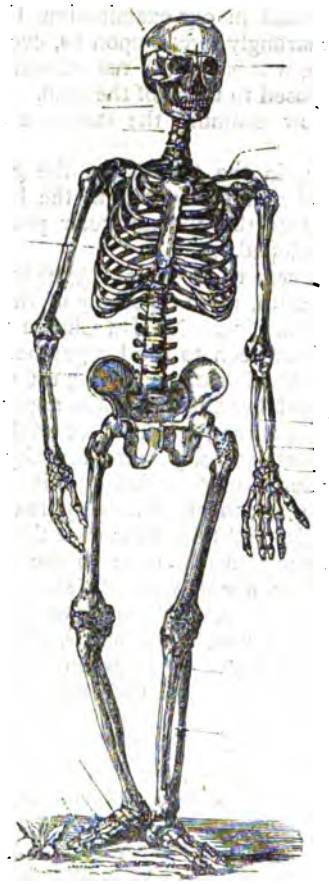
In the former, the 'occipital foramen,' or in plainer language, the orifice in the base of the skull through which the spinal cord passes to the brain, is placed so far back that the whole weight of the head is thrown forward, tending, of course, to overbalance the body. In man, this orifice is placed almost in the centre, so that the head is evenly poised upon the spinal column.

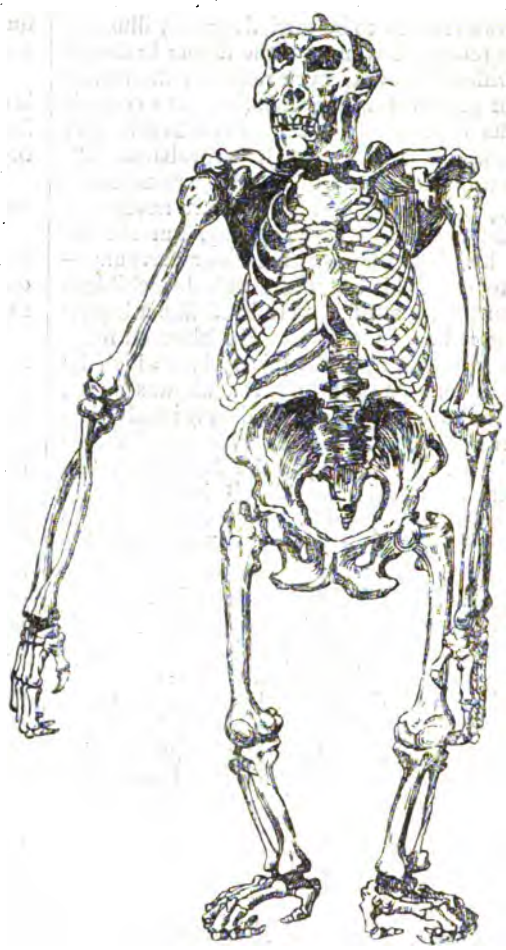
With regard to the feet, the cause is evident without the need of dissection, for these organs are formed almost exactly like hands, being provided with thumbs and fingers instead of toes. They are, in fact, almost identical in form with the hands themselves. Naturally, as they can possess no heel, and as there is no 'calf,' *i.e.*,

the set of powerful muscles below the knee, which are required for the working of the foot, these hinder hands cannot be placed flat upon the ground; an erect position is therefore rendered impossible.

In fact, when an ape endeavours to stand upright, the feet can only be placed sideways upon the ground. The movements are consequently so awkward and uncertain that the animal is obliged to assist itself in its progress by its arms, which are of such length that the fingers almost touch the ground when their owner is standing in as erect a position as he is able to assume.

The Orang-outan, indeed, one of the large apes, always uses these long arms as crutches when walking upon a level surface, placing the knuckles of the hands upon the ground, and swinging the body between them.





Unfitted as is this structure, which is common in a greater or less degree to nearly all the monkeys, for locomotion upon land, it is not so for their movements in their natural home, namely, the forest. The immense strength of the arms, the hand-like structure of the hinder feet, and even the very form and attitude of the body, are as much adapted to an arboreal life as they are unsuited for an existence spent upon the ground.

Look at a monkey upon a level surface, for instance, as it travels awkwardly along, seeming, indeed, scarcely to know what to do with its limbs. Look at the same creature when it has gained the branches of some tree, and is making its way from bough to bough with an easy grace and agility which are as much opposed to its former ungainly motions, as are the evolutions of a swan when swimming from the movements of the same bird when it essays to travel upon dry land. In both cases, one would hardly recognise the awkward, clumsy animal for the agile, graceful creature which it subsequently proves to be; and even Caliban and Ariel are hardly more widely different both in movements and appearance, than is the monkey upon land from the monkey in the trees.

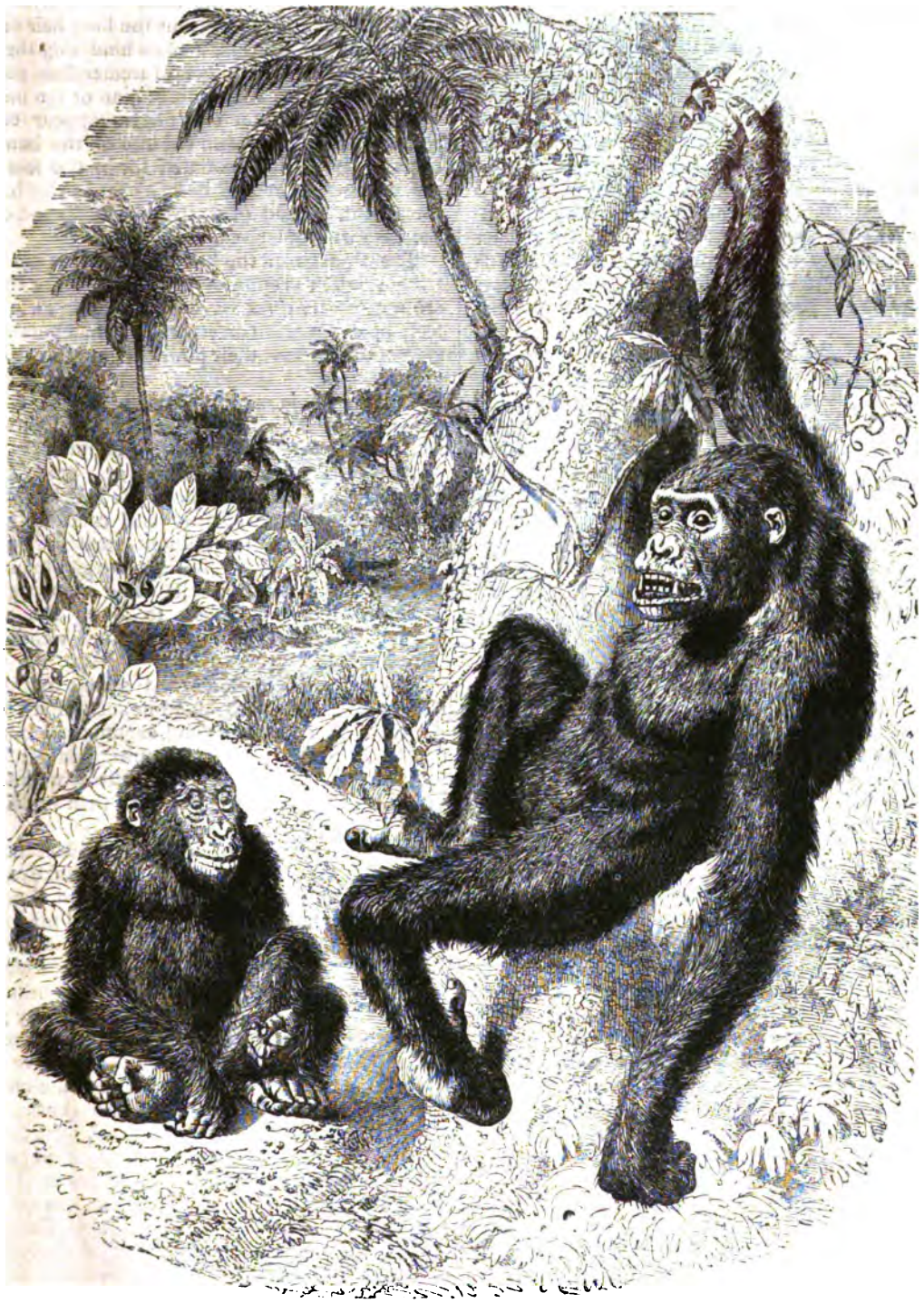
With the large apes, however, the difference is not so noticeable as with some of the smaller animals of the group—such, for example, as the Gibbons,—their huge weight and clumsy form debarring them from progressing among the branches with the speed and agility exhibited by monkeys more delicately and gracefully formed.

The structure of the head, more than all else, bears witness to the wide gulf separating the man from the beast. The jaws form the most prominent feature, protruding far in advance of any other part of the face; the teeth are more aptly to be described by the word 'tusks'; the nostrils are placed flat upon the face, the nose, which gives so much expression to the human countenance, being altogether wanting; and, more especially, the brain is very small in proportion to the other parts of the frame.

Naturally, the reasoning powers are developed only in a corresponding degree.

A very mistaken notion appears to prevail that monkeys are infinitely more clever and intelligent than other animals. True, they are crafty and cunning, few animals more so; but craft and cunning alone do not constitute intellect, and if the reasoning powers of the monkeys be fairly weighed, we shall find that they are far excelled by those of many animals very much lower in the order of creation than themselves.

Fortunate is it for mankind that the mental powers, at any rate of the large and powerful apes, are not equal to their physical qualifications. For were these animals to become aware of their vast strength, and also to be acquainted with the means of using it to the best advantage, they would become enemies whose powers of mischief could scarcely be over-estimated.



As it is, monkeys in their wild state do not seem to have very much idea of the use of a weapon. Occasionally, perhaps, one of these animals will lift a stick,

and even endeavour to strike with it. But he will have so little notion of using his strength, that the force of the blow given will be far less than if the arm and hand only had been used.

Again, their power of hurling missiles is very slight, and indeed by some travellers has been altogether denied. The late Mr. Charles Waterton was one of these, and indignantly repudiated the idea that any monkey could hurl or throw any object whatever in any possible manner. Here, however, he was wrong. That monkeys both can and do hurl missiles can be easily proved by any visitor to the monkey-house at the Crystal Palace. In one of the large cages there is, or was a short time since, a baboon, together with several monkeys considerably inferior in size to himself. In order to check his propensity for subjecting his smaller comrades to severe bodily castigation, this baboon is fastened by a chain around his body, which obliges him to confine his perambulations to a part only of the cage.

Naturally enough, his companions know to a fraction of an inch the reach of the captive animal when at the full stretch of his tether, and never venture inside the charmed circle. Unable, however, to resist the temptation of insulting the prisoner, they are accustomed to eat nuts, etc., presented by the visitors, an inch or so without the magic line, knowing that the sight of the coveted dainties will goad the captive to madness.

In the course of a few seconds their anticipations are fulfilled, and the infuriated animal attempts to revenge himself by hurling the straw from the bottom of the cage at his tormentors, plying them with armful after armful until the supply is exhausted. An exhibition of this nature can be generally produced by offering some little dainty to one of the smaller monkeys in sight of the captive baboon.

Mr. A. R. Wallace, also, the well-known traveller and naturalist, states, in his work upon the Malay Archipelago, that he has, upon three occasions at least, known the orang-outan to hurl down dead branches, etc., upon the heads of its pursuers. Other travellers also have made similar statements, so that the power of monkeys to hurl projectiles, although not perhaps with any great force or accuracy of aim, can no longer be doubted.

One mode of annoying foes upon the ground is a very curious one.

Taught by instinct, monkeys will never trust themselves upon dead branches. But when they have wished to drive away foes beneath them, they have been seen to hang from a sound branch by their hands, and swing themselves repeatedly towards a dead branch, striking it violently with their feet at every swing, and repeating the process until the branch was snapped and fell to the ground.

To return to our gorilla.

The size of this ape, like that of the elephant, has been greatly exaggerated by many travellers. Six, seven, and even eight feet have been mentioned as the height to which the animal attains, whereas the average is little more than five feet, even a large male seldom reaching five feet six inches in height. However, a monkey only five feet high is a very large animal, and when the breadth of body and length of arm, and the almost herculean strength of its limbs, are taken into account, it may easily be imagined that an infuriated gorilla is by no means an insignificant foe.

The hair is almost black in colour, appearing less dark, however, in some lights, and becoming of a greyish hue upon the cheeks and the top of the head. Upon the arms it is arranged in a very curious fashion, the hair from the shoulder to the elbow growing in a downward direction, while from the elbow to the wrist the exact reverse is the case. This arrangement is probably intended to prevent the long hair of the wrist from being included in, and so hindering the grasp.

The hand of the gorilla is of tremendous dimensions, often attaining to a breadth of nine or ten inches. To outward examination the fingers appear to be very short in comparison with the size of the hand. This, however, is easily accounted for by the fact that they are connected by the flesh as far as the base of the third joint, instead of to that of the second only, as is the case with ourselves.

The thumbs of the hands themselves are comparatively small in proportion to the size of the fingers, and are not of very great service to the animal. Upon the feet, however, the corresponding members are of far greater dimensions, their power of grasp being extremely great.

The gorilla is an inhabitant of the thick forests of that part of Africa known as the Gaboon, where it is far from uncommon. In spite of its numbers, however, several causes have prevented any great knowledge being gained with regard to its life and habits.

In the first place, so wary and cautious an animal cannot be approached without great difficulty, more especially in the dense forests in the gloomiest recesses of which it loves to dwell. The snapping of a twig would be amply sufficient to alarm the suspicious animal, and acquaint it with the vicinity of an intruder.

Then, again, the fierce and savage nature of the animal causes it to be held in such dread that none but the most courageous and experienced hunters will venture to penetrate into its haunts. Little information, too, is to be gathered from the natives, who look upon the animal with far greater fear than upon the most infuriated lion.

The prevailing idea of the native inhabitants appears to be that the large apes are not monkeys, but wild men, who retire to the woods and feign dumbness in order to avoid being taken captive and made to work. Some tribes also consider that the gorillas are animated by the souls of former savage kings, whose ferocity and love of slaughter continue undiminished.

The disposition of the gorilla alters very greatly at different periods of the animal's existence. While still young, before the savage instincts have had sufficient time to become fully developed, the character of the ape is comparatively mild and gentle. 'Gena,' the last gorilla brought to England, for example, was of a fairly peaceable disposition, the chimpansee who bore her company being far more prone than herself to fits of passion. 'Gena,' however, was quite young, and had she lived, would probably have become terribly morose and sullen by gradual degrees, just as has been the case with all the other apes which have been taken while young, and bred up in captivity. As the bodily powers increase, the mental attributes proportionately diminish, the intelligence of the baby ape being far superior to that of the adult animal.

Like many animals of the monkey tribe, the gorilla seldom lives for very long when kept in captivity. Its constitution seldom enables it to withstand the change of climate, and it inevitably succumbs, before many

months are over, to the great foe of the monkey race in this country, namely, consumption.

As to the habits of the gorilla in its purely wild state, it is not likely that we shall ever know much about them.

Its instinctive wariness enables it to detect the approach of an enemy at a considerable distance, and, like the elephant under similar circumstances, it can slip away so quietly that a traveller might pass through a spot which was tenanted by the apes only a few minutes before, and fancy that not a gorilla could be found within miles around.

Moreover, like the monkey tribe in general, the gorilla is ever on the move, so that a colony of these apes is an impossibility. The gorilla seems to live in families, and the whole family moves about together, led by the parents until the young are old enough to leave their parents and set up in life for themselves.

Again, the districts which these creatures inhabit are of such a character that no white man could live long enough to make trustworthy investigations, even if he succeeded in evading the vigilance of the apes. The pure West African negro might do so, but his intellect is quite inadequate to the task.

Nor is there much likelihood of watching their habits in captivity, as the European climate is quite unsuitable to the gorilla. It requires a temperature far above that which is needed by most monkeys, and it must have plenty of space and abundance of warm and constantly changing air.

The chimpansee 'Tommy' who lived for some years in the Crystal Palace, retained perfect health during his captive life, simply because Mr. F. W. Wilson, who took charge of him, fulfilled both these conditions. Had he not perished in the fire which consumed the tropical department, he might have been alive at the present time.

The gorilla, however, requires much more care than the chimpansee. When the young gorilla, 'Gena,' was at the Crystal Palace in August, 1879, she never seemed to be warm enough. Even at night, when put into her travelling cage and placed near a stove, she always pressed herself against the bars, and held her little black paws as close to the stove as they could reach.

The only plan whereby there would be any hope of preserving the life of a gorilla in this country would be to build a large and thick-walled house expressly for the purpose. An equable temperature of not less than 75° Fahr. would be required, and there must be an ample supply of air constantly driven through it.

Equability of temperature is a necessity. Once, at the Crystal Palace, while Gena was there, a sudden shower came on. A sharp N.E. wind was blowing, and the evaporation over the immense roof cooled the air so fast that the temperature fell more than 20° in a very short space of time.

Gena seemed to be quite paralyzed by the change, against which no one could have guarded, and indeed she never seemed to recover the shock. I had the opportunity of inspecting her after death, and saw that one lung was entirely useless and the other nearly so.

ANOTHER African ape is the Chimpansee (*Troglodytes niger*), which inhabits the same parts of Africa as the gorilla. Except in inferiority of size, it is by no means unlike that animal; for which, especially while young, it might easily be mistaken. Indeed, for many years the gorilla was thought to be nothing more than an adult chimpansee.

An unfailing point of distinction, however, may be found in the ears. These, in the gorilla, lie close to the head, and are as small and well-shaped as those of many a human being. In the chimpansee, however, these organs are of far greater size, and stand out boldly from the head, giving an expression to the face which at once distinguishes it from that of the gorilla.

Similar as they are in appearance, however, in habits they are very different. The gorilla is an inhabitant of the forest, like nearly all the members of the tribe, spending almost the whole of its existence among the branches, and only descending to the ground when obliged. But the chimpansee forms an exception to the general rule, and is a dweller upon the ground, taking up its abode in rocky and precipitous neighhoods. The title '*Troglodytes*' has been applied to the genus on account of the dwelling-places selected by this animal, that word signifying a 'diver into caverns,' and therefore being very appropriate.

It may be imagined that an animal dwelling in so comparatively exposed a situation would be particularly liable to the attacks of the larger *Carnivora*. No single chimpansee would be a match for a lion, or even for a leopard, for its strength, great as it is, would be of little use against the fangs and talons of its opponent.

However, the chimpansee, unlike the gorilla, which is more or less a solitary animal, recognises the principle that unity is strength, and accordingly congregates into small flocks, the members of which combine for purposes both of offence and defence. Not even the elephant, huge and powerful as it is, can stand against the onslaught of a band of these animals, which can collectively bid defiance to any foe excepting man himself.

Like most animals which congregate together for mutual protection, the chimpansees post sentinels at intervals round the camp, in order to give early warning of the approach of any foe. Should an enemy be seen, the nearest sentry gives notice of the impending danger by means of a sharp, shrill cry, the meaning of which is perfectly understood by every member of the band. A conversation is then kept up, in the peculiar barking cry of the animals, until the onslaught takes place, or the foe listens to the dictates of prudence and retraces his steps.

According to the reports of the natives, the chimpansees construct huts for themselves, which are inhabited by the females and the young, the males keeping guard upon the roof. These stories have not as yet been verified; but as the orang-outan, a closely-allied ape, is known to weave similar structures in the trees, there is at least a likelihood that such may be the case with the chimpansee. One species of chimpansee certainly does construct a roof, under which it sits.

The food of the chimpansee seems to be entirely of a vegetable nature, the animal subsisting chiefly upon fruit of various sorts. Consequently, it is a terrible foe to agriculturists who are unfortunate enough to possess plantations near the haunts of the animal, the apes stripping them of their produce as soon as the fruit ripens.

The chimpansee appears to be a somewhat long-lived animal, as it does not attain to maturity until after attaining the age of nine or ten years. A speci-

men has been known to live for twenty-one years in captivity, and it is probable that this period would have been considerably extended had the animal been allowed to remain free and unfettered in its native haunts.

(To be continued.)

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Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

No. XI.—THE LEPIDOPTERA. PART I.

THE butterflies and moths form the order scientifically termed *Lepidoptera*, which is placed next upon the list. This name signifies 'scale-winged,' and is applied to the insects of the group on account of the scales with which both the upper and under surfaces of the wings are closely covered. The structure of these scales has already been explained in the third of this series of papers.

The most important of the remaining characteristics of the group is found in the structure of the mouth, which is formed for suction only. The mandibles, or outer jaws, are rudimentary only, and scarcely visible without close examination. The maxillæ, or inner jaws, however, are developed to a very great extent, and form a long trunk, or proboscis, through which liquids can be sucked into the mouth. When not in use, the proboscis is coiled away beneath the head.

The Lepidoptera are generally considered to form two natural groups, known respectively as butterflies and moths, the members of the former being distinguished from those of the latter by their clubbed antennæ, by the form of the body, and by the position of the wings when the insect is at rest.

As far as the British Lepidoptera are concerned, these distinctions are amply sufficient to separate the insects of the one group from those of the other, the clubbed antennæ alone being a sufficiently marked characteristic.

But, when we come to examine the insects of other parts of the world, we find that these points of difference no longer hold good. Many exotic moths, for instance, possess antennæ far more strongly and distinctly clubbed than those of most butterflies, while those organs in several genera of the latter insects are as plain as is usually the case with the moths. The form of the body, too, can no longer be relied upon as a distinguishing feature, and there is really no characteristic which can be decided upon to invariably separate the insects of the two groups. It is, therefore, considered by our leading authorities that the Lepidoptera form one large group only, divided into a number of smaller families. In the present paper, however, as the Lepidoptera of our own country can alone be described, we shall still consider the insects as being divided into two great sections.

The butterflies are divided into five families, which are distinguished chiefly by the veining of the wings, the form of the antennæ, and, more particularly, by the development of the legs. For, in many butterflies, the first pair of these organs are so short and imperfect as to be quite unsuitable for the purpose of walking, and it is even doubtful whether they fulfil any functions whatever. So small are they, indeed, that to a careless observer they would be totally invisible. The structure of both the larva and pupa are also taken into account.

The first of these five groups comprises the *Papilionidæ*, the members of which, although, with one exception, few and insignificant in this country, attain to great size and beauty in tropical lands.

The beautiful Swallow-tail Butterfly is our one representative of tropical magnificence, and even this solitary example seems likely before very long to become extinct as far as Great Britain is concerned. It is found in marshy land only, and is almost entirely confined to the fens of Cambridgeshire, Norfolk, and Huntingdonshire. In some parts of these counties it is still found in tolerable plenty, although the draining of the marsh-land, combined with the attacks of insect collectors, is rapidly diminishing its numbers.

The most familiar insects of this family are the 'White' butterflies, so plentiful in every part of the country from early spring to late autumn. These butterflies are the parents of the caterpillars which devastate our cabbage-crops, and which are in consequence held in the greatest detestation by the agriculturist. Indeed, were it not for their untiring foe, the little Ichneumon-fly (*Microgaster*), it is doubtful whether a single cabbage-plant would be free from their attacks. The labours of this little fly, indeed, deserve our warmest gratitude, for, thanks to its ravages, the most important of these butterflies, namely, the Large Cabbage White, is now comparatively scarce, hardly a single specimen being now seen where formerly the insect existed in thousands.

As an instance of the multitudes in which the larvæ of this butterfly have sometimes appeared, the following extract from Coleman's 'British Butterflies' may be of interest:—

'A note in the "Zoologist," p. 4547, by the Rev. Arthur Hussey, gives us the following:—"For the last two summers many of the gardens of this village have been infested by caterpillars to such an extent that the cabbages have been utterly destroyed." When the time for changing to the chrysalis state arrived, the surrounding buildings presented a curious appearance, being marked with long lines of the insects travelling up the walls in search of a suitable place of shelter for undergoing their transformation. A great number of caterpillars took refuge in a malthouse, from which they could not escape as butterflies, the result being that for several weeks the maltster swept up daily many hundreds of the dead insects.'

In the same work an instance is given of the valuable services rendered to man by the *Microgaster* in destroying these larvæ.

'In 1842,' says Mr. Coleman, 'a vast flight of white butterflies came over from the Continent to the coast about Dover, and, spreading inland from thence, did an immense amount of damage to the kitchen gardens; but so effectually did the ichneumon flies do their work, that an exceedingly small proportion of the caterpillars resulting from this flock of immigrants went into the chrysalis state, nearly all perishing just before the period of change.'

Various small birds also contribute largely to the destruction of these caterpillars, which they devour in great numbers.

The eggs of this butterfly are very curious objects, being shaped something like skittles, each egg standing upright, and deposited in little clusters of ten or

twelve. When placed under the microscope, these eggs are seen to be covered with a raised pattern, a number of bold ribs running from top to bottom, while a series of raised transverse lines pass over both ribs and interstices. These eggs may generally be found by examining the leaves of the cabbages in May and August, the butterfly being double-brooded.

The chrysalis is suspended by a thread round the middle to any convenient object, such as a post or wall.

The Smaller White Butterfly, now by far the more abundant of the two insects, is, in one way, even more destructive than the preceding insect, for the larva bores into and devours the very heart of the cabbage, while that of the larger white is contented with the outer leaves. Consequently, it is not so readily detected and destroyed, being concealed from the view of most of its enemies.

To this group also belongs the beautiful Brimstone Butterfly, which is so common throughout the year in most parts of the country.

The next family, that of the *Nymphalidæ*, comprises a considerable number of species, comparatively few of which, however, possess special interest to any but an entomologist. Among these exceptions, however, we may mention the insects of the genus *Vanessa*, which includes the beautiful Peacock and Scarlet Admiral Butterflies, the Tortoiseshell, and some others.

Most of the Vanessas feed, while in the larval state, upon the leaves of the common stinging-nettle, which they roll up in order to form a hiding-place where they may be concealed from the view of their enemies. The chrysalis is always suspended by the tail, and is, in all the species of the genus, a very beautiful object, being plentifully adorned with gilded spots, looking like so many patches of gold leaf.

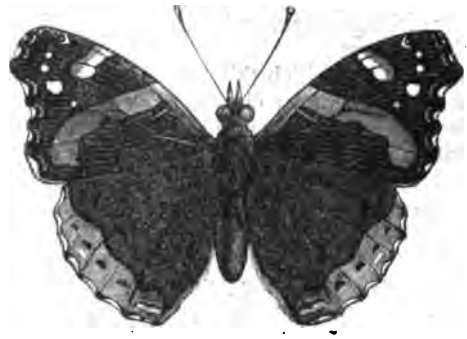
These butterflies emerge from the chrysalis at the beginning of autumn, and pass the winter, in a state of torpor, in some sheltered retreat. Old barns, church towers, hollow trees, etc., are usually resorted to by numbers of hibernating butterflies, which remain motionless until the warmer days of spring tempt them once more to exercise their wings.

But their demeanour is then entirely changed. During the few weeks which intervened between their release from the pupal shell and their retreat to their winter's hiding-place, their occupation was solely that of seeking amusement, or extracting the sweet juices from various honey-bearing flowers. But as soon as spring arrives, they enter upon the serious business of their lives, viz., that of providing for a future progeny, and the female butterflies, worn and battered in their passage through life, may then be seen flitting slowly along the roadsides in search of some convenient spot in which to deposit their eggs. This done, their work is over, and they seldom survive the operation for more than a few hours.

The Scarlet Admiral Butterfly is perhaps the most generally known of these insects, its broad black wings, with their stripes of brightest red, being familiar to almost every resident in the country. It may sometimes be seen in countless numbers, resting upon the blossoms of the ivy-bushes on a sunny morning, in company with others of the same genus. In such a case, the effect of the mass of black and crimson wings, slowly opening and closing as their possessors regale upon the sweet juices, is almost magical.

One of the families of butterflies, the *Erycinidæ*, although numbering many members in foreign countries, possesses only a single representative in Great Britain. This butterfly, quite a small species, bears the somewhat lengthy title of 'Duke of Burgundy Fritillary.' It is a curious fact that the males of all the insects of the family have four fully-developed legs only, while the females possess the normal number of six.

Remarkable for the bright, metallic tinting of their wings, the Blues and Coppers are included in the



Scarlet Admiral.

family of the *Lycænidæ*. In these all six legs are fully developed in both sexes. In common with the Skipper Butterflies (*Hesperidæ*), these do not possess any great general interest, and we will therefore proceed to the second great section of the *Lepidoptera*, which includes those insects popularly known as Moths.

In these insects there is far more variety in shape and size, at least as far as our British species are concerned, than in the butterflies. Indeed, the antennæ alone of the insects comprising the group are sufficiently diverse in form to have earned the title of *Heterocera, i.e.*, 'varied-horned,' for the section.

The first family of these insects, the *Sphingidæ*, consists of the large Hawk-moths, which form a very distinct group. The scientific title was derived from the fanciful likeness supposed to exist between the larvæ of these moths and the Egyptian sphinx.

Although this resemblance is not very striking to an ordinary eye, the larvæ are yet very interesting creatures, furnishing, on account of their large size, very suitable objects in which to watch the life-history of the Lepidoptera. They nearly all possess upon the upper surface of the twelfth segment of the body a curious curved horn, the object of which is altogether unknown. That it cannot be intended as a weapon either of defence or offence is evident enough, for the substance of which it is composed is not sufficiently firm to allow it to cause the slightest harm, even to the most sensitive skin.

The popular term of 'Hawk' moth is appropriate enough, for, both in form and flight, these insects strongly resemble the birds after which they are named. With such remarkable speed, indeed, do they pass through the air that the eye cannot follow their movements, the insects seeming to vanish and reappear as if by magic. Most of them are nocturnal in their habits, and may be seen hovering over flowers at dusk.

Our largest British moth, the Death's-head Hawk, is the most prominent member of this family, and attains to a very considerable size, a large specimen being often as much as five inches in expanse of wing. The caterpillar too is of very great size, and is found in potato-fields, that plant constituting its food.

It is, however, often found upon the jessamine, and, as a rule, a caterpillar which is found upon jessamine will not eat potato, and *vice versa*.

Owing to the curious skull-like mark upon the thorax, from which the insect derives its name, the Death's-head Moth has been, and still is, regarded with superstitious views by the uneducated portion of the community. Its advent is thought to presage death or misfortune, and the insect is consequently regarded with great awe and terror. Its peculiar faculty of uttering a shrill squeak when alarmed is almost invariably considered as a proof of its supernatural attributes.

The method in which this sound is produced has never been satisfactorily cleared up. Some observers have thought that it is caused by the friction of the palpi with the proboscis, others by the movement of the head against the thorax, and so on. Neither of these theories, however, will hold good when we take into consideration the fact that the sound is produced, not by the perfect insect alone, but also by the larva, and, more curious still, the pupa. The *modus operandi*, therefore, of producing the squeak employed by the insect during the various stages of its existence, has still to be determined.

It is currently reported in the south of France, where the insect is abundant, that the death's-head moth is in the habit of making its way into the bee-hives in order to feast upon the honey contained in the cells.

Want of space permits us to mention one more moth of the hawk tribe only, and we will therefore select the aptly-named Humming-bird Hawk-moth. This insect so closely resembles, both in form and habits, the little bird whose name it bears, that even residents in the tropics, who have been acquainted with humming-birds from their earliest childhood, have been deceived by the wonderful likeness borne to those birds by the hawk-moths. This resemblance is still further increased by the habit of the hawk-moth of hovering over the flower while extracting its juices, the humming-birds themselves feeding in exactly the same manner.

This is one of the swiftest of the tribe when upon the wing, vanishing and re-appearing with the rapidity of lightning. It is common in most parts of the country, and differs from nearly all the members of the family in that it flies by day instead of by night.

Next to the hawk-moths most authors place the *Sesiidæ*, or Clearwings, insects whose wings are only partly covered with scales. One of our leading authorities, however, considers that they are out of place in their present position, and removes them to a totally different group.

The greater number of these clearwing-moths bear so close a resemblance to bees, wasps, gnats, etc., as to deceive any but an experienced entomologist. The larvæ are all 'internal' feeders, in other words, they live inside the roots, stems, twigs, or even the solid wood itself, of various plants and trees.

The next family, the *Zeuzeridæ*, is a very small one in this country, consisting of two species only. Both are wood-boring insects while in the larval state, the more familiar of the two being especially interesting.

This is the well-known Goat-moth (*Cossus ligniperda*), so-called from the odour proceeding from the burrows of the larva, which somewhat resembles the scent of the he-goat. The perfect insect, although common, is not very often seen, being of a very sluggish temperament, and seldom stirring forth until after dark.

The larva feeds upon the solid wood of various trees, such as the oak and the willow, frequently causing great damage by its network of burrows. Its jaws are admirably fitted for their duties, for they are so powerful that scarcely any substance short of iron or tin will withstand their attacks. These caterpillars have even been known to perforate sheet-lead, so it may be easily imagined how rapidly the wood upon which they feed is cut away by their powerful mandibles.

Larva of Privet Hawk-moth.

By a curious provision, the pupa of this insect, as well as that of its congener, is able to travel along its tunnels with considerable speed. The edge of each segment is furnished with a row of little hooks, by the aid of which the pupa can wriggle itself along almost as rapidly as when in the caterpillar state. Just before the perfect insect emerges, the pupa travels in this manner to the mouth of the tunnel, in order that the moth may not be incommoded by want of space.

The development of this insect extends over a considerable period of time, the larva alone requiring four years in order to complete its growth. The egg from which it springs is deposited by the parent insect deeply in the bark of the tree by means of her long ovipositor, the little caterpillar travelling into the wood immediately it is hatched. From the time it is hatched until it attains the pupal condition, it never seems to cease feeding. Consequently, a tree attacked by these larvæ is so weakened by the combined attacks of the caterpillars, sixty or seventy of which are often found in the same trunk, that it dies as surely as if the woodman's axe had laid it low. So plentiful and widely-spread is the insect, that it is hardly possible to find a row of willow-trees several of which do not exhibit signs of the presence of the destroyer, while many a noble tree is so riddled by the tunnels that scarcely a cubic inch of sound wood is to be found in the trunk.

(To be continued.)

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: 'MECHANICS.'

IN this article I will reproduce one of the lessons upon force, work, energy, and machinery. There seems to be a little vagueness in the use of some of these terms by even our leading men of science. Professor Guthrie, for instance, uses the term 'energy' not quite in the sense that Tyndall uses it. In most of the little text-books read in our schools there is, however, very considerable confusion, and other words are introduced, such as 'power,' 'strength,' etc., to which no very definite meaning is attached. All this tends greatly to the bewilderment of both scholars and teachers. In my lessons I endeavour to keep to the sense in which Grove, Tyndall, and Huxley use them.

Look, boys! I have taken my knife, and am making a point to this piece of chalk. What do you see is happening to the particles of chalk? Ans.—They are falling to the ground. Where were they before they fell? Ans.—On to the piece of chalk. What kept them there? Ans.—The attraction of cohesion. What made them come away from the stick of chalk? Ans.—The knife. The knife? Ans.—Yes, sir. Then what did *I* do? Ans.—You moved the knife up and down. (A boy)—It was you, sir, and not the knife, that made them come off. (Another boy)—It was the knife, because you could not cut them off without a knife. (The previous boy)—Yes; but the knife could not cut them off without you. Well, Jones, you seem to be thinking very deeply, what do you say? Ans.—Well, sir, I was thinking that it was not you nor yet the knife that made them come off: it was the power you put into the knife. (A boy)—It was the force of your arm, sir. Quite right, Howell, my boy. Now what do we call that force? Ans.—Muscular force. What was it, therefore, that this muscular force did? Ans.—Moved the knife up and down. And what resulted from that? Ans.—The particles of chalk came off. Then what did the muscular force accomplish in the end? Ans.—Cutting away the chalk. Yes: we will call that the 'work' that was done. Now let us go over this again. What is the work to be done? Ans.—Cutting away the chalk. What is the force employed? Ans.—Muscular force. Now what duty does the knife perform in all this? Answers—It is the thing you use. It is the instrument. It comes between the force and the work. Very good, Smith. (A boy, Jones)—It connects the force applied with the work to be done. That's capital, Jones: is that sentence your own? Ans.—No, sir: I read it in a book. (A boy)—Please, sir, what Jones says is what a *machine* does. Indeed! is it? Ans. (same boy)—Yes, sir: it says, 'A machine connects the force applied with the work to be done.' Well, don't you agree with that? Ans.—No, sir: a knife is not a machine. Indeed! why not? Ans.—Because it has no wheels, and bands, and things of that sort, and it does not go by steam. Well, let us stop a minute or two to see what a machine really is. Here we have a picture of the 'striking mechanism of a clock.' Now tell me what is the work to be done in this case? Ans.—The hammer striking against the bell. And what is the force employed to accomplish this? Ans.—That weight going down. Yes; but what causes the iron weight to go down? Ans.—The attraction of gravitation. Is that a force? Ans.—Yes, sir. Why? Because it causes motion. Well, now, what comes between this force and the hammer? Ans.—All those wheels and things. Exactly so; and what do we call all those wheels? Ans.—The machinery. Here, again, is a picture of what we call the 'mechanical powers.' We shall have a great deal to say about them next year. You see the representation of a man lifting a log of wood? Ans.—Yes, sir. What is the force he uses to do this work? Ans.—The strength of his arms. Yes; muscular force. You see he does not put his arms round the log and lift it that way: can you tell me why? Ans.—He is not strong enough. Yes; or, in other words, he has not sufficient muscular force. Well, what is he using? Ans.—A bar of iron, a crow-bar. Yes: that is called a 'lever.' Now what is it that connects the force applied, which is muscular force, with the work? Ans.—A lever. What, therefore, is a lever? Ans.—A machine. Yes; it is called a 'simple machine;' and you see, Smith, it has no wheels nor bands, and does not go by steam. Last Saturday I saw at the gas-works, Kent Road, a steam-engine at work, raising immense boxes of gravel and sand from a great depth. (A boy)—Yes, sir: my father works there, and they got up some tremendous tusks and bones of elephants. Yes, I know: they were bones of the 'mammoth;' but we won't go into that now. What was the force employed here? Ans.—Steam. (A boy putting up his hand.) Well? Please will you give us a lesson some day about those bones, how they got in the gravel? Yes, I will; but never mind about that now. You say that steam was the force employed. That is only partly right. Ans.—The expansive force of steam. Ah, that is better. But what caused the expansion? Ans.—Heat. Therefore, what was really the force employed? Ans.—Heat. Yes; and you have heard me say that the heat force in the coal came first of all from the sun; but we won't go back so far as that. We will say that the force applied was the expansive force of steam. What is the work to be done? Ans.—Lifting up the gravel. And what connects the force with the work? Ans.—The machinery. Yes. Here, Smith, we have wheels, and bands, and things of that sort. Do you think we could apply this force without anything coming between? No, sir. Now just think. Could we use steam, without the machinery, to send all this gravel to the top? (A boy)—Yes, sir; we could. How? We might put the boiler down the hole underneath a box of gravel, then make the water so hot that the boiler burst, and the gravel and all the other things would all be blown up to the top. (A boy)—Please, sir, that wouldn't do. No: that would be very inconvenient, still it would be getting the gravel to the top. But do you know of any instance where the force *is* applied without anything coming between? No answer. Well, how do they get the great blocks of stone from the rock in the quarry? Ans.—By blasting. What *is* blasting? Ans.—A hole is bored in the rock, some gunpowder is put in and then lighted, and the great blocks of stone are blown off. Very good; and when force is applied in this way we say it is applied 'direct.' This is, however, very seldom the

case; generally something connects the force with the work, and then we say the force is applied 'indirect.'

Have any of you ever seen a water-wheel? I see not many of you have. Well, here is a picture of a water-wheel and a flour-mill. What do you think is going on in that little house? Ans.—Grinding corn. Yes; that is the work. Now what is the force employed here? Ans.—The force of that water coming down the mountain. But what gives the water this force you speak of? Ans.—Coming such a long way down the hill. Then if it did not come such a long way wouldn't it have so much force? Ans.—No, sir. Just explain what you mean. Ans.—If you had the mill much higher up the mountain, just where the stream begins, there would be very little force, not enough to turn the wheel. Well? Ans.—And if you took the mill nearer to the bottom of the mountain there would be ever so much more force. (A boy)—Please, sir, that would be because there would be ever so much more water. How would there be more water? Ans.—Because other streams would join it. (The previous boy)—What would be the use of having ever so much more water if it didn't run? you might have ever so much water at the top, but if it didn't run it would do nothing. Now, Jones, don't get angry: let us try to get at the truth about it. You have said there is a force in the water; that the farther the water has run down the hill, and the more there is of it, the greater the force is. Let us think about this. (A boy holding up his hand.) Well? Ans.—Please, sir, there is not any force in the water at all. Oh, indeed! then *you* disagree with all that has been said? Ans.—Yes, sir. It's the force of gravitation acting upon the water and making it come to the bottom: it's the weight of the water. (Another boy)—It is not only because there is more water at the bottom that makes it have more force. What makes you think that? Ans.—Because if there were only the same quantity of water running at the bottom as near the top, it would still have greater force. Why? Ans.—Because it has been running down a greater distance. (A boy)—Please, sir, in the last lesson you told us about a hoop running down a hill: is this about water the same? But what did I tell you that the hoop running down a hill was an instance of? Ans.—Accelerated velocity. (A boy putting up his hand.) Well? Ans.—Can you have accelerated force? Yes, you can; and that is a very sensible question. But at present I shall say nothing about that: we will go into the subject of accelerated force, as you call it, when we have a lesson upon 'momentum.' What is really the force which causes that water to run down the mountain? Ans.—The attraction of gravitation. Yes; that is the force which is applied to do the work of grinding the corn.

Now suppose somebody had a spite against the man at the mill, and so went higher up the mountain, and placed a quantity of stones and earth in the bed of the stream, so as to block it up: what would happen? Answers—The water-wheel would stop. The stream would not come to the mill. The miller would come out and see what was the matter. And what would he find *was* the matter? Ans.—That the force had stopped. Indeed! what force? Ans.—The force of the water. But what have we just said that really was? Ans.—The force of gravitation. Then do you mean to say that the force of gravitation had stopped acting? Ans.—No, sir: it is still acting. Upon what? Ans.—Upon the water on the other side of the stones. Now I want you to think carefully. Tell me what is the difference between the action of this force *now* that the stream is blocked up, and *before*, when it caused the water to turn the mill. (A pause, during which every boy is thinking. Surely a moment of delight in the life of a teacher, whose own psychic force is reflected from every eye.) Answers—The force is acting, but it is not grinding the corn. Before, the force did work: now it does nothing. There is more and more force getting in the water on the other side of the wall. (A boy raises his hand.) Well? Ans.—If the stones and things were knocked away, and all the water came rushing down, it would do more work than it did before. You think it would? Yes, sir: it would make the wheel go round very fast. (Another boy)—I don't think it would do any work at all: it would wash the mill and the wheel all down to the bottom of the hill. Very well; now I will take one or two of your answers, and see what we can make of them. It was you, Johnson, I think, who said there was more and more force getting in the water on the other side of the stones: what makes you think so? Ans.—Because the water is getting higher and higher. (A boy)—The man must keep on bringing more and more stones. Why? Ans.—If he did not, the water would soon have power enough to break down the wall altogether. How did the water get this power that you speak of? Ans.—By the force of gravitation. Now what word would you use when speaking of more and more things collected together, such, for instance, as more and more stones? Ans.—A heap; an accumulation; a collection. Just so. Now what is there an accumulation of in the mass of water? Ans.—Force. And what is force able to accomplish? Ans.—Work. I will now write on the board a name for such an accumulation of force, or such a store of power to do work—'Energy;' and this is its meaning, 'power to do work.' (A boy)—Please, sir, is it called 'energy' when it does work? Ans.—Yes, certainly. (Same boy)—Then energy is the same as force. (Another boy)—No; it is not the same: energy is a lot of force that has been stored up, and then all coming out. (A boy)—It is energy before it does come out. The fact is we want words to describe all this. It is not quite right to talk about 'energy coming out;' still you have, I think, the correct idea. If the energy exists, but is not in operation, like the energy in the mass of water still on the other side of the wall, we say it, that is the water, has 'potential energy,' which I will write down on the board; but if we knock down the wall, and allow the energy to operate in performing work, we then say the energy is 'actual.' Now, boys, our lesson has been rather a long one. Just take out your exercise-books and write these definitions:—Force is that which produces or tends to produce motion, or changes or stops motion. Work is the result of the application of force. Machinery is the apparatus for conveniently connecting, and passing on, the force applied with or to the work to be done. Energy is the power to perform work, stored-up force. If the energy is in operation it is termed 'actual energy:' if it exists, but is not in operation, it is called 'potential energy.'

ANSWERS TO
Pupil Teachers' Examination Paper.
JANUARY 28TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. How much will it cost to travel 715 mls, if it costs 3s. 4½d. to go 11½ mls.?

11½ mls. : 715 mls. :: 3s. 4½d. : cost required.

$\frac{161 \text{ far.} \times 1430}{23} = 10010 \text{ far.} = £10\ 8s.\ 6\frac{1}{2}d.$ Ans.

2. Neglecting fractions of a farthing, find the value of 2,002 acres, 3 roods, 4 poles, 5 yards at the rate of 11 guineas per acre.

			£	s.	d.
Value of	1 ac. =		11	11	0
					10
,,	10 ,, =		115	10	0
					10
,,	100 ,, =		1155	0	0
					20
,,	2000 ,, =		23100	0	0
,,	2 ,, =		23	2	0
,,	2002 ,, =		23123	2	0
,,	2 ro. = ¼	val. of 1 ac. =	5	15	6
,,	1 ,, = ½	,, 2 ro. =	2	17	9
,,	4 po. = 1/40	,, 1 ,, =		5	9½
,,	5 yds = 1/1210	,, 1 ,, =			2⅝ 80/1331
	Value of whole =		£23132	1	3 80/1331

3. Find cost of 263 tons, 7 cwt., 0 qrs., 14 lbs., 15 oz. at 10s. 10d. per oz.

(a) 263 tons, 7 cwt., 14 lbs., 15 oz. = 9438703 oz.

		£	s.	d.
(b) Total value at £1 per oz.	=	9438703	0	0
,, ,, 10s. = ½ val. at £1	=	4719351	10	0
,, ,, 10d. = 1/120 ,, 10s.	=	393279	5	10
Total value at 10s. 10d. per oz.	=	£5112630	15	10

4. Working 10 hours a day, it takes 15 labourers 18 days to get through 450 yds. of a trench. How many men, working two hours a day, would in 8 days finish 480 yds.?

2 hrs. : 10 hrs.
8 days : 18 days
450 yds. : 480 yds.
:: 15 labourers : men required.

15 lab. × 1/5 × 1/9 × 480/450 = 15 × 12 = 180 men. Ans.

FEMALES.

1. Find the cost of 1398 articles at £3708 9s. 10½d. each.

		£	s.	d.
Value of whole at	£1 each =	1398	0	0
				3708
		11184	0	0
		978600	0	0
		4194000	0	0
,, ,,	£3708 ,, =	5183784	0	0
,, ,,	10s. = ½ val. at £1 =	699	0	0
,, ,,	£3708 10s. =	5184483	0	0
Subtract val. of whole at 1½d. = 1/720 of val. at £1 =		7	5	7½
∴ exact value of 1398 arts. =		£5184475	14	4½

2. A clerk having to pay 1000 workmen £1 5s. 4½d. each, receives from his employer £1000 for this purpose, and this, together with £9 18s. 6d. of his own, he expends in paying each man in full as far as the money goes; how many men remain unpaid?

(a) Number of men paid = (£1009 18s. 6d. ÷ £1 5s. 4½d.) = 484764 halfd. ÷ 609 halfd. = 796 men.

(b) ∴ 1000 − 796 or 204 men remain unpaid. Ans.

3. Make out the following bill:—1 cwt. of tobacco at 2½d. an ounce, 2 tons of sugar at 4½d. per lb., 3½ cwt. of treacle at 1½d. per lb., 2¾ cwt. of cheese at 6s. 9d. per doz. lbs., a tub of butter (containing 74½ lbs.) at £4 18s. per cwt.

	s.	d.		£	s.	d.
1 cwt. at	0	2½	per oz. =	16	16	0
2 tons at	0	4½	,, lb. =	84	0	0
3½ cwts. at	0	1½	,, lb. =	2	0	10
2¾ cwts. at	6	9	,, doz. lbs. =	8	13	3
74½ lbs. at	98	0	,, cwt. =	3	5	2½
				£114	15	3½ Ans.

4. Find the value of an estate of 1343 acres 3 rds. 19 po. at £42 3s. 4d. an acre.

		£	s.	d.
Value of 1 ac. at £1	=	42	3	4
,, 1343 ac. = (£1343 × 42⅛)	=	56629	16	8
,, 2 ro. = ¼ val. of 1 ac.	=	21	1	8
,, 1 ,, = ½ ,, 2 ro.	=	10	10	10
,, 20 po. = ½ ,, 1 ro.	=	5	5	5
		56666	14	7
Take off ,, 1 po. = 1/160 ,, 20 po.	=		5	3½
∴ exact val. of estate =		£56666	9	3½

Grammar.

1. Parse the verbs and adjectives in the following:—

'Toll for the brave!
The brave that are no more;
All sunk beneath the wave
Fast by their native shore.'

Toll—reg. trans. verb (used here as intrans.) imper., pres., 2nd per. plur., agreeing with (*you*).
brave—adj. qual. (*men*) here equal to a noun.
brave—adj. qual. (*men*), emphasizing first *brave*.
are—irreg. subst. verb *am, was, been*, indic., pres., 3rd pers. plur., agreeing with *that*.
sunk—complete part. of irreg. intrans. verb *sink, sank, sunk* referring to *all*.
their—poss. adj. limiting *shore*.
native—disting. adj. limiting *shore*.

2. Define clearly an abstract noun; give examples.

An 'abstract noun' is the name of a *quality* considered apart from the thing with which it is connected, or of an *action* considered apart from the doer of that action, or of the *state* of any common or proper noun. That which is denoted by an abstract noun has no independent existence, but is only *thought of by* itself.

Abstract nouns are formed from (1) adjectives; *e.g., goodness, whiteness, fruitfulness.* (2) Verbs, *e.g., laughter, speech.* (3) Concrete nouns, *e.g., tyranny, boyhood.*

3. Give examples (1) of nouns having two plurals; (2) of nouns that admit of no plural.

(1) Some nouns of foreign extraction have both an English and a foreign plural, with different shades of meaning, *e.g., genius, genii* and *geniuses; index, indexes,* and *indices; formula, formulæ,* and *formulas.* Some A. S. words give two plurals:—*brothers* and *brethren; cloths* and *clothes; dies* and *dice; pennies* and *pence.*

(2) Some nouns, from the nature of their signification, do not admit of a plural. These are names of *materials,* as, *gold, silver, clay, timber; abstract nouns,* as *temperance, wisdom, compassion.* Many of such nouns are used in the plural to denote different kinds or instances of the substances or qualities referred to.

Geography.

1. Name in order the river mouths, bays, headlands, and principal seaports between the Firth of Clyde and the Bristol Channel. Describe briefly the character of each seaport.

On the Firth of Clyde are the seaports of *Greenock,* with shipbuilding and sugar-refining, and *Port Glasgow,* with shipbuilding. Proceeding southwards, we pass *Ardrossan,* with steam to Ireland, *Mouth of the Irvine, Ayr Bay,* with *Ayr* at the *Mouth of the Ayr, Turnberry Point, Girvan* at the *Mouth of the Girvan, Loch Ryan, Corsill Point, Portpatrick*—steam to Ireland, 21 miles off—*Mull of Galloway,* at which point we enter the *Solway Firth,* parts of which are *Luce Bay, Wigtown Bay,* and *Kirkcudbright Bay. Burrow Head* lies between Luce and Wigtown

Bays. The chief rivers entering the Solway are the *Dee*, the *Nith*, with its port of *Dumfries*, the *Annan*, and the *Eden* in Cumberland. Continuing south, along the English coast, we pass the coal ports of *Maryport*, *Whitehaven*, and *Workington*, round *St. Bee's Head*, reach *Barrow-in-Furness*, cross the mouth of *Morecambe Bay*, receiving the waters of the *Lune*, skirt the coast of Lancashire, on which stand *Fleetwood*, *Blackpool*, *Preston* at the mouth of the *Ribble*, and *Liverpool* and *Birkenhead* (in Cheshire), a combination-town forming the most wonderful example of seafaring enterprise in this or almost any country of the world. Crossing the *Estuary of the Dee*, we coast along Wales, past *Great Orme's Head*, through the *Menai Straits*, with *Bangor*, round the peninsula of *Braich-y-pwll* into *Cardigan Bay*, a long stretch, at the south end of which are *Strumble Head* and *St. David's Head*. The peninsula of Pembroke is cut by *St. Bride's Bay* and *Milford Haven*, leaving which we pass *St. Gowan's Point*, enter *Caermarthen Bay*, and beyond *Worms Head*, we reach our destination, the *Bristol Channel*.

2. What differences of climate are there between the East and the West Coasts of Great Britain? Give reasons for these differences.

The average fall of rain over Great Britain is much greater on the West than on the East coast, the average number of rainy days on the east being 165 and on the west 208. This great difference of climate between the east and west sides arises from the configuration of the land and the general prevalence of westerly winds, charged with vapour from the Atlantic. These winds, meeting with the cooler mountain ranges, lose their moisture and give rise to nearly all the principal rivers in the island. The barren hills on the West are almost continually shrouded in mist, while the districts beyond them receive only the proper amount of water.

3. Say what you know about the physical features and industrial pursuits of Cornwall, Durham, Ayrshire, and Galway.

If you can, draw a map to illustrate *one* answer, and insert the lines of latitude and longitude.

Cornwall has a rugged surface, an indifferent soil, and a scarcity of timber. Its climate is mild and healthy, but very moist. Its tin mines are the most celebrated in the world. The district richest in metals extends from Dartmoor in Devonshire to Land's End, but the most varied mineral wealth is confined to a little space in the southern end of the peninsula, to which place fully nine-tenths of the people have been drawn to follow the industries of tin and copper mining.

Durham consists of moorlands with lead mines in the Pennine Chain; a tract of coal-measures in the middle; and a belt of agricultural soil on the coast, in the southern part of which salt-mines are found. The three chief rivers rise close together in the W., and are the *Tyne* forming the N. boundary, the *Tees* the S., and the *Wear* running through its centre. The chief industries are coal and iron mining, the manufacture of glass, shipbuilding, salt-making, sail-cloth manufacture, and shipping.

Ayrshire lies on the Firth of Clyde, and is separated from the basin of that river by a low range of hills on the N.E., while on the S.E. it is bounded by the hills stretching from the Lowthers to the Solway. It is crescent-shaped, and watered by five main streams, rising in the eastern hills, the chief of which is the Ayr, dividing the county into two parts. In the south lies *Carrick*, very hilly, thinly peopled, and chiefly devoted to pasture-land; to the N., is *Cunningham*, pastoral and rich in coal-measures; and between these is *Kyle*, the richest and most populous of the three parts, forming one of the centres of Scotch manufacturing industry. Kyle and Cunningham are thickly crowded with towns and villages, whose outward trade is carried on through the ports of the Clyde. Ayrshire has been called the *dairy* of Scotland, and gives name to a breed of cattle.

Galway in general consists of an immense level plain, extending far inland, bounded by the *Suck*, the *Shannon*, and *L. Derg*. The smaller portion of the county is composed by a mass of heights, the *Connemara Mts.*, running towards the sea along the shores of Galway Bay, and almost cut off from the level tract by *Loughs Mask* and *Corrib*. The rocky district is barren and deserted, and the few small towns lie in the river valleys of the plain. The chief industry is farming; the cattle fairs of Balinasloe being the most important in Ireland.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

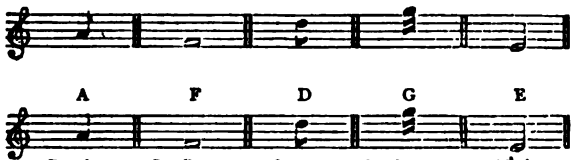
Write in large hand, as a specimen of copy-setting, the word, *Harpsichord*.

Write in small hand, as a specimen of copy-setting, *Poised in mid air upon the giddy mast.*

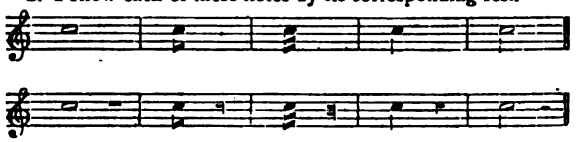
Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (D, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.



3. Suppose we make one beat while we sing a crotchet, how many shall we make while we sing a minim?

If we make one beat while we sing a crotchet, we must make *two* beats while we sing a minim, because a minim is equal in duration to two crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. Reduce 7 quarters 5 bushels 3 pecks 1 gallon 2 quarts to the decimal of a quarter.

4 | 2 qts.
2 | 1·5 gall.
4 | 3·75 pk.
8 | 5·9375 bush.
7·7421875 quarters. Ans.

2. If to one person a testator bequeaths $\frac{9}{20}$ of his property, to another $\frac{1}{4}$, and to another the remainder, viz., £300, what is the value of the whole property?

After $\frac{9}{20} + \frac{1}{4}$ are given away there remains $\frac{20 - (9 + 5)}{20}$ or $\frac{3}{20}$ of the whole, ∴ the whole $= \frac{£300 \times 10}{3}$ or £1,000.

3. If $\frac{5}{7}$ of a lb. cost $\frac{3}{4}$ of a shilling, what will $\frac{3}{8}$ of a cwt. cost?

$\frac{3}{8}$ cwt. $= \frac{336}{8}$ lbs.
∴ $\frac{5}{7}$ lbs. : $\frac{336}{8}$ lbs. :: $\frac{3}{4}$s. : cost required.
$\frac{3}{4}$s. $\times \frac{336}{8} \times \frac{7}{5} = \frac{2268}{160}$s. $= £2\ 1s.\ 9\frac{3}{20}$d. Ans.

4. If an oz. of gold be worth £4·18953, what is the value of ·3753 lbs.?

(*a*) ·3753 lb. × 12 = 4·504 ozs. Troy.
(*b*) £4·18953 = val. of 1 oz.

4·504
1675813
209476666
1675813333
£18·86905813 = ,, 4·504 ozs.
20
17·39316263s.
12
4·7179512d.

∴ the Answer in £ s. d. = £18 17s. 4 7...d.

FEMALES.

1. A person after paying a poor rate of 10d. in the pound has £728 6s. 8d. remaining: what had he at first?

After paying 10d. in the £ he has 230d. left out of 240d.
∴ 230d. : 240d. :: £728⅔ : total required.
$£728\frac{2}{3} \times \frac{240}{230} = £760$. Ans.

2. A garrison of 1,000 men, which was victualled for 60 days, was reinforced at the end of 18 days, and then the provisions were exhausted in 30 days: what was the number of men in the reinforcement?

When the reinforcement arrived there were provisions for 42 days.
∴ 30 days : 42 days :: 1,000 men : total in garrison.
1,000 men × $\frac{42}{30}$ = 1,400 men.
∴ Reinforcement = 1,400 − 1,000, or 400 men. Ans.

3. If the carriage of 15 tons 17 cwts. 1 qr. of goods for 257¾ mls. cost £16 6s. 7½d, what weight at the same rate will be carried 211½ mls. for £21 15s. 6d.?

£16 6s. 7½d. : £21 15s. 6d.
or or
7,839 halfd. : 10,452 half'd.
846 qrs. of ml. : 1,031 qrs. of ml.
} :: 1,269 qrs. : weight reqd.

$\frac{1,269 \text{ qrs.} \times 10,452 \times 1,031}{7,839 \times 846} = 2,062 \text{ qrs.} = 25 \text{ tns. } 15 \text{ cwt. } 2 \text{ qrs.}$

4. A wall that was to be raised 36 ft. high was raised 9 ft. in 6 days by 16 men: how many more men must be employed to finish it in 4 days?

9 ft. : 27 ft. (rem. of wall)
4 days : 6 days
} :: 16 : total men required.

$\frac{16 \text{ men} \times 27 \times 6}{9 \times 4} = 72$ men in all.
∴ the extra number = 72 − 16, or 56 men. Ans

Grammar.

1. Parse all the pronouns in the following:—

'How happy is he born or taught,
That serveth not another's will,
Whose armour is his honest thought,
And simple truth his highest skill.'

he—pers. pron., 3rd pers. sing., mas., referring to (*man* indefinitely), nom., subj. of *is*.
that—simple rel. pron., referring to *he*, 3rd pers. sing., mas., nom., subj. of *serveth*.
another's—indef. pron., 3rd pers. sing., mas. (or fem.) p ss., attrib. to *will*.
whose—simple rel. referring to *he*, 3rd pers. sing., mas., poss., attrib. to *armour*.
his—poss. adj. pron., 3rd pers., limiting *thought*.
his— ,, ,, ,, *skill*.

2. In the following sentence show that a preposition makes an intransitive verb transitive:—

'Full well they laughed with counterfeited glee
At all his jokes; for many a joke had he.'

The verb *laughed*, which is generally intransitive, is rendered transitive by means of the preposition *at*. If it were said that '*they laughed*' the action is confined to the actors, but the phrase '*they laughed at*' requires an object to complete the meaning, which is supplied in '*all his jokes*.' To test if such combinations are true 'compound' or 'preposition-verbs,' as they are sometimes called, try if they make good sense in the passive form; as, '*His jokes were laughed at*.' This proves *at* to be virtually part of the verb *laugh*.

3. Give examples of adverbs of manner, time, and place.

The following are adverbs of
Manner—rapidly, well, so, thus, somehow, anywise.
Time—when, to-day, hereafter, lately, by-and-by.
Place—here, yonder, up, anywhere, where, homewards.

Adverbs of *time* may be classified into those denoting (1) When? (2) How long? (3) How often? and those of *place* into (1) Where? (2) Whither? (3) Whence?

Geography.

1. Draw a full map of Spain and Portugal. Insert the lines of latitude and longitude.

2. Trace minutely the course of the Loire, mentioning in order its tributaries and the towns in its basin, and describing the character of the country through which it flows.

The *Loire* rises in the Cevennes, flows with a winding course towards the north as far as Nevers, near which it is joined by the *Allier*, a tributary which, rising in the same chain of mts., flows parallel with the Loire, from which it is separated by a range of hills. From Nevers the Loire proceeds to the north-west until it reaches *Orleans*, where it bends to the west and continues in this direction till it falls into the Bay of Biscay. In this part of its course it receives the *Cher*, *Indre*, and *Vienne* of the left, and the united *Mayenne*, *Sarthe*, and *Loir* on the right These are its principal feeders, but the branches received by the Loire are very many, and this river constitutes the great outlet for the produce of central and western France. The banks are celebrated for their beauty, particularly in the neighbourhood on Tours. The chief towns in its basin are *Le Puy*, *St. Etienne*, *Nevers*, *Clermont*, *Moulins*, *Orleans*, *Tours*, *Limoges*, *Poictiers*, *Saumur*, *Alençon*, *Le Mans*, *Mayenne*, *Angers*, and *Nantes*.

History.

1. Make a list showing names and dates of our kings from 802 to 901.

			A.D.
Egbert	became	King of the West Saxons ...	802
,,	,,	,, English kingdom	829
Ethe'wulf	,,	,, ,,	837
Ethelbald	,,	,, ,,	858
Ethelbert	,,	,, ,,	860
Ethelred I.	,,	,, ,,	866
Alfred	,,	,, ,,	871
Edward the Elder	,,	,, ,,	901

2. Write out the succession of our sovereigns from Henry II. to Edward II., with dates.

		A.D.
Henry II.	began to reign ...	1154
Richard I.	,, ...	1189
John	,, ...	1199
Henry III.	,, ...	1216
Edward I.	,, ...	1272
Edward II.	,, ...	1307, deposed 1327.

3. What sovereigns reigned in England during the eighteenth century? Give the dates of accession.

William III. was reigning at the beginning of eighteenth century, and the date of his accession was A.D. 1680

Anne	began to reign	....	1702
George I.	,,	....	1714
George II	,,	....	1727
George III.	,,	....	1760

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Harpsichord*.

Write, in small hand, as a specimen of copy-setting, *Poised in mid air upon the giddy mast*.

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

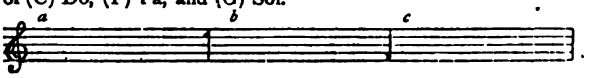
A quarter of an hour allowed for this Paper.

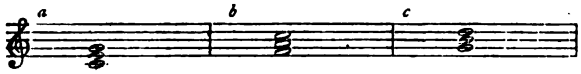
1. What is meant by a *sound*, what by a *tone*; and how does a sound differ from a tone?

Sound is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones. The natural scale has eight sounds, rising in successive steps by tones and semitones, the latter being found between the third and fourth, and seventh and eighth sounds.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) Do, (F) Fa, and (G) Sol.



A *triad* is the addition of its third and fifth to any given note.

3. How many tones and how many semitones are found in a diatonic scale, and what are the places in it of the latter?

In a diatonic scale are found five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. At what rate per cent. per annum will £79 amount to £100 in 7½ years? Give your answer in £ s. d.

Interest in 7½ years = £100 − 79 = £21.

" 1

∴ 7½ yrs. : 1 yr. } :: £21 : rate p. c.
£79 : £100 }

$$\frac{£21 \times 2 \times 100}{15 \times 79} = \frac{£280}{79} = £3\ 10s.\ 10\tfrac{10}{79}d.$$ Ans.

2. A warehouse contains goods worth £17,230, and is insured only for 86·3 per cent. of its value; what sum would be lost in case of its destruction by fire?

Since $\frac{86{\cdot}3}{100}$ is covered by insurance, then $\frac{13{\cdot}7}{100}$ will be lost in case of its destruction, *i.e.*,

$\frac{13{\cdot}7}{100}$ of £17,230 = £172·3 × 13·7

172·3
13·7
12061
5169
1723.
£2360·51 = £2360 10s. 2·4d. Ans.

3. An agent who is paid 2½ per cent. on all money he collects receives £57 as commission; how much has he collected?

£2½ is got from £100
1 " " $\frac{100}{2\frac{1}{2}}$
∴ £57 " " $\frac{400 \times 57}{11}$

i.e., £$\frac{22800}{11}$ or £2072 14s. 6$\frac{6}{11}$d. Ans.

4. In what time will a sum of money double itself at 3½ per cent. per annum simple interest?

In other words, '*In what time will* £100 *gain* £100 *at* 3½ *p. c. per annum?*'

£100 brings £3½ in 1 yr.
£100 " £1 " $\frac{2}{7}$ "
∴ £100 " £100 " $\frac{200}{7}$ yrs., or 28$\frac{4}{7}$ yrs. Ans.

FEMALES.

1. Compare the values of:—
(*a*) $\frac{3}{4}$, 1$\frac{2}{3}$, $\frac{1}{2}$ of $\frac{1}{4}$, 1, and $\frac{1}{4}$ of $\frac{1}{4}$ of 1$\frac{1}{10}$; and simplify
(*b*) $\frac{64}{280} + \frac{9}{70} + \frac{1}{4} + \frac{3}{42}$

(*a*) simpler = $\frac{3}{4}$, 1$\frac{2}{3}$, $\frac{2}{5}$, 1, and $\frac{11}{280}$
or $\frac{240}{320}$, 1$\frac{2}{3}$, $\frac{112}{320}$, 1, and $\frac{11}{280}$.

Hence, according to value
(1) 1$\frac{2}{3}$, (2) 1, (3) $\frac{2}{4}$, (4) $\frac{1}{2}$ of $\frac{1}{4}$, (5) $\frac{1}{2}$ of $\frac{1}{4}$ of 1$\frac{1}{10}$.

(*b*) $\frac{84 + 36 + 70 + 20}{280} = \frac{210}{280} = \frac{3}{4}$. Ans.

Note—$\frac{3}{12} = \frac{1}{4}$.

2. A man gave 15 tons of coals among the poor, giving each 1$\frac{3}{4}$ cwts.; among how many persons did he divide it?

No. of persons = 15 tons, *i.e.*, 300 cwts. ÷ 1$\frac{3}{4}$ cwts. = $\frac{300}{\frac{7}{4}}$ = 180. Ans.

3. Oats are worth $\frac{4}{5}$ of 7s. 6d. a bus., and hay £3 10s. a ton; how many bushels of oats ought to be given for 2$\frac{1}{2}$ tons of hay?

$$\frac{£3\frac{1}{2} \times 2\frac{1}{2}}{\frac{4}{5} \text{ of } 7\frac{1}{2}s.} = \frac{£\frac{35}{4}}{\frac{3}{10}s.} = 175s. \div \tfrac{3}{10}s.$$
$$= \frac{175 \times 10}{75} = \frac{112}{3} = 37\tfrac{1}{3} \text{ bus.}$$ Ans.

4. What is the value of $\frac{7}{331}$ of 1 ton 77 lbs.?

$$\tfrac{7}{331} \text{ of 1 ton 77 lbs.} = \frac{2317 \text{ lbs.} \times 78}{331}$$
$$= 7 \times 78 = 546 \text{ lbs.}$$
i.e., 4 cwts. 3 qr. 14 lbs. Ans.

5. If 1½ bus. of wheat will sow 1½ ac., what will the wheat cost for 37 ac. at £3 4s. a quarter?

Price of wheat per bus. = $\frac{64}{8}$s. = 8s. ∴ 1½ bus. cost 10$\frac{2}{3}$s.

Hence 10$\frac{2}{3}$s. × $\frac{37 \text{ ac.}}{1\frac{1}{2} \text{ ac.}}$ = $\frac{32}{3}$s. × $\frac{74}{3}$ = $\frac{2368}{9}$s. = £13 3s. 1$\frac{7}{9}$d.

Grammar.

'Only a sweet and virtuous soul
Like seasoned timber never gives;
But, though the whole world turn to coal,
Then chiefly lives.'

1. Point out the two co-ordinate sentences in the above, and analyse fully the subordinate sentence.

1st sentence:—'Only a sweet and virtuous soul
Like seasoned timber never gives.'
2nd sentence:—'But, though the whole world turn to coal,
Then (*it*) chiefly lives.'

Analysis of Subordinate Sentence (of concession).

'Though'...	...	... *Connective (subordinate).*
'world'	...	... *Simple subject.*
'the whole'	...	... *Enlargement of subject.*
'turn'	...	... *Incomplete predicate.*
'to coal'	...	... *Complement of predicate.*

2. Point out the conjunction in the above that joins the two co-ordinate sentences, and say to which class it belongs.

'*But*' is the co-ordinating conjunction, and as it contrasts the second sentence with the first, it belongs to the *adversative* class of co-ordinating conjunctions.

3. What are subordinate conjunctions? Give examples.

Subordinate conjunctions are those which connect sentences of which one *enters into the construction of the other sentence with the force of an adverb or a noun.*

Simple	subordinate conj.:	—that
Temporal	"	" —now, since, after.
Causal	"	" —because, for, lest.
Conditional	"	" —if, except, whether.
Concessive	"	" —though, although.
Alternative	"	" —whether—or.

Geography.

1. Draw a full map of Australia.

Insert the lines of latitude and longitude; and explain how they are useful in drawing a map.

The lines of latitude and longitude are useful in fixing the positions of places exactly as they are on the earth itself. They form, in fact, a complete set of guiding lines for drawing a correct representation of parts of the earth.

2. Give notes of a lesson on the climate and production of British North America.

(1) CLIMATE.—In Canada the climate is *excessive*—the heat of summer and the cold of winter being much greater than in corresponding latitudes in Europe—dryness of the air and absence of high winds greatly moderate the severity of winter, and render the climate salubrious and conducive to lengthen human life; dangerous epidemics are almost unknown, people troubled with affection of the lungs enjoy better health than in Britain; sky pure, and fogs seldom seen; winter begins in Lower Canada in November and ends in April; in Upper Province it is shorter; on borders of Great Lakes winter is milder than in the interior; the St. Lawrence is generally frozen for five months in the year.

In British Columbia, embracing all British America west of the Rocky Mountains, the climate is very moist in summer and extremely cold in winter; in elevated interior snow blocks up the mountain passes from October to July.

In Hudson's Bay, or North-West Territory at Fort York, the winter cold is intense, the thermometer descending so low as 50° below zero, brandy freezing into a solid substance, in rooms with a constant fire.

Newfoundland Coast much subject to fogs, no doubt from the condensation of the vapour from the warmer sea.

(2) PRODUCTIONS.—*Animals*—Fur-bearing, such as bear, wolf, fox, lynx, etc. Carriboa-deer in vast herds in Newfoundland, to which island the Newfoundland dog is peculiar. Two remarkable features in Canadian bird-life:—1, Birds are all destitute of song; 2, The stated migration of birds in immense crowds to and from the Arctic regions. Domestic animals comprise horses, sheep, swine, and poultry; seas, bays, and rivers swarm with fish; 'bank of Newfoundland' long celebrated for its cod. Game of all kinds abound in the whole territory.

Minerals.—All the known useful minerals are found in this vast region. Gold in British Columbia and Nova Scotia; copper in Lake Huron and Lake Superior very valuable; maritime provinces of Canada comprise inexhaustible supplies of coal and ironstone, building and other stone of all descriptions.

Vegetables.—Wheat of the finest quality grown in the greatest abundance, apples and cider exported, sugar from maple tree, all the home fruits, etc., grown in Canada. Great forests of timber produce "lumber," which is the source of great wealth, especially in New Brunswick. Hemp and flax are indigenous to the soil, and can be grown profitably in many parts. Agriculture is now taking the place of the original timber trade, which, however, still forms the most valuable branch of commerce.

SECOND PAPER.

One hour allowed for Females.
Two hours and a half allowed for Males.

History.

1. What British prince early in the sixth century checked the extension of Wessex? Give place and date of a battle won by him.

In 495 a body of Saxons, under Cerdic and his son, founded the Kingdom of Wessex; but in 520 the British prince, Arthur, defeated the Saxons at Badbury, in Dorsetshire, and checked for a whole generation their advance westwards.

2. How came Richard I. to be taken captive by the Duke of Austria? Narrate the circmstances.

Richard I., in his hurry to get home from the Crusades, had left his fleet and gone on as a private traveller. Having been wrecked on the coast of the Adriatic, he made his way in disguise into Austria, where he was seized by Leopold, Duke of that country, who had been insulted by Richard during the Crusade. The Duke sold him to the Emperor, Henry VI., who did not release him till such a heavy ransom was paid that every Englishman had to give a fourth of his goods.

3. Mention names and dates of the most famous battles between English and French from Edward III. to Henry VI.

Battle of Crecy, fought 1346, gained by Edward III.
,, Poictiers ,, 1356 ,, Black Prince.
,, Agincourt ,, 1415 ,, Henry V.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *harpsichord.*

Write, in small hand, as a specimen of copy-setting, *Poised in mid air upon the giddy mast.*

Composition.

Write full notes of a lesson on *simple geometrical forms.*

Notes of a lesson on '*Simple geometrical forms.*'

I.—Class provided with slates and pencil, and seated in front of blackboard—two points made—ask pupils to join them with the shortest line possible—this called a *straight* or *right* line—join points with other lines not straight but *curved*—two straight lines drawn side by side, neither approaching nor receding from each other—these *parallel* straight lines—two lines drawn to form a corner, such *corner* called an *angle*—one line standing upright on another, said to be at *right* angles—a ruler may be made to do duty as a moving line to show the formation of angles as *acute* or *obtuse.*

II.—Ask for a figure made with three lines—compare this with the *triangle* of a musical band—question on number of sides and angles—sides may be all of same length—two may be equal—or all unequal—give names *equilateral, isosceles*—angles may be all equal, &c. After exhausting triangles, proceed to four-sided figures—ask for objects having four lines bounding them—show figures with opposite sides parallel—explain parallelogram—*square* with four sides equal, and angles, right angles—show *oblong* or *rectangle*—and so proceed to other four-sided figures, asking for examples of each at every step.

III.—Make a point on board, and place many points equally distant from it round it—ask for objects of a similar shape, as wheels, coins, &c.—question on position of the first with respect to the others—and give the names *circle* and *centre*—draw lines from the centre to the points in the *circumference* (which explain)—the lines resembling *spokes* of a wheel—or *rays*—*radii* (explain)—and finish lesson with *diameter, semicircle, arc, chord,* &c.

NOTE.—During the lesson the pupils should follow on slates the work of the teacher on the blackboard, and each new word should be printed clearly, and the class practised in the pronunciation of these terms.

Euclid.

[All generally understood abbreviations for *words* may be used.]

1. Name the different parts of which every proposition consists. What is the distinction between a *direct* and an *indirect* demonstration?

Every proposition, when complete, may be divided into six parts:—

(1) *The proposition* or *general enunciation*, stating in general terms the conditions of the problem or theorem.
(2) *The exposition*, or *particular enunciation*, which exhibits the *subject* of the proposition in particular terms as a fact referring to some diagram described.
(3) *The determination* contains the *predicate* in *particular* terms as it is pointed out in the diagram, and directs attention to the demonstration, by pronouncing the thing sought.
(4) *The construction* applies the postulates to prepare the diagram for the demonstration.
(5) *The demonstration* shows the possibility or impossibility of the problem, and the truth or falsehood of the theorem in the particular case exhibited by the diagram.
(6) *The conclusion* is merely the repetition of the general enunciation wherein the predicate is asserted as a demonstrated truth.

A *demonstration* is said to be *direct* when the predicate is inferred directly from the premisses, as the conclusion of a series of successive deductions. When a result is established by showing that some absurdity follows from supposing the required result to be untrue, the demonstration is called *indirect.*

2. If two triangles have two sides of the one equal to two sides of the other, each to each, and have likewise their bases equal: the angle which is contained by the two sides of the one shall be equal to the angle contained by the two sides equal to them of the other.

See Prop. VIII. Bk. I.

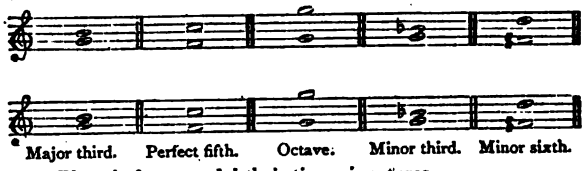
3. If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles.

See Prop. XVI. Bk. I.

Music.

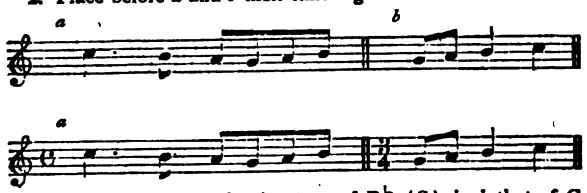
A quarter of an hour allowed for this Paper.

1. Write, under each of the following intervals, its name (second, third, or other) and quality (major, perfect, or other).

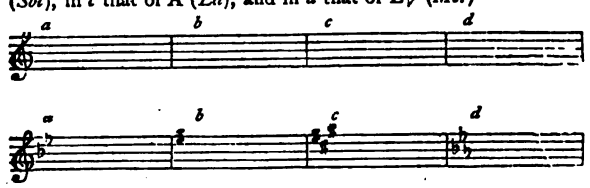


Major third. Perfect fifth. Octave. Minor third. Minor sixth.

2. Place before *a* and *b* their time signatures.



3. Write in *a* the scale signature of B♭ (*Se*), in *b* that of G (*Sol*), in *c* that of A (*La*), and in *d* that of E♭ (*Me.*)



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* 1*st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. By selling 26 yards at 3s. 4½d. per yard a draper gains 6s. 6d. What was the prime cost per yard, and what is the gain per cent.?

(*a*) 26 yds. gain 6s. 6d. ∴ 1 yd. gain ¼d. or 3d.
∴ prime cost per yd. = 3s. 4½d. − 3d. or 3s. 1½d.

(*b*) 3s. 1½d. gains 3d. or $\frac{6}{75} = \frac{2}{25}$ of whole.
∴ gain per cent. = $\frac{2}{25}$ of 100, or 8. Ans.

2. What amount of capital is that which after having been employed at 5½ per cent. simple interest for four years, becomes £5,000?

Amount of £100 for 4 yrs. at 5½ p. c. = £122.
∴ £122 : £5,000 :: £100 : principal required.

$$\frac{£100 \times 5000}{122} = \frac{250,000}{61} = £4,098\ 7s.\ 2\tfrac{4}{61}d.$$ Ans.

3. What sum invested in the 3 per cents. at 98¼ will purchase £7,268 worth of stock?

£100 of stock will be purchased by £98¼
1 „ „ $\frac{98\frac{1}{4}}{100}$
∴ £7,268 „ „ $\frac{£7,268 \times 98\frac{1}{4}}{100}$
i. e. £7,140·81
i. e. £7,140 16s. 2·4d. Ans.

4. What is the exact present value of a debt of £572 due eight months hence at 3·75 per cent. simple interest?

Int. of £100 for 8 mo. at 3·75 p.c. per ann. = £3·75 × $\frac{8}{12}$ = £2·5
Amount „ „ = £102 5
∴ £102·5 : £100 :: £572 : exact pres. val.

$$\frac{£572 \times 200}{205} = \frac{572 \times 40}{41} = \frac{22,880}{41} =$$

£558 0s. 11$\frac{19}{41}$d. Ans.

FEMALES.

1. Divide 172·9 by ·142 to three decimal places.

$$\frac{172·9}{·142} = \frac{172900}{142} = 1217·605\ldots$$ Ans.

2. Convert $\frac{3}{5} + 3\frac{1}{8} + 2\frac{9}{20} + 6\frac{11}{125}$ into a decimal.

$\frac{3}{5} = \frac{6000}{10000}$
$3\frac{1}{8} = 3\frac{1250}{10000}$
$2\frac{9}{20} = 2\frac{4500}{10000}$
$6\frac{11}{125} = 6\frac{880}{10000}$

$11\frac{10838}{10000} = 12\frac{838}{10000} = 12·038$. Ans.

3. Express the difference between ¾ pk. and ·0625 of a bushel as the decimal of a quarter.

(*a*) ¾ pk. = ·75 pk. = ·1875 bush.
∴ ·1875 bush − ·0625 bush. = ·125 bush.
(*b*) ·125 bush. ÷ 8 = ·015625 qr. Ans.

4. Divide 50 into two parts, such that one shall exceed the other by 6·75.

$$\text{Greater} = \frac{50 + 6·75}{2} = \frac{56·75}{2} = 28·375$$

$$\text{Less} = \frac{50 - 6·75}{2} = \frac{43·25}{2} = 21·625.$$ Ans.

Grammar.

'O, my *Lord*,
Press not a falling man too far; 'tis virtue:
His faults lie open to the laws; *let* them,
Not you, *correct* him. My heart weeps to see him
So little of his great self.'—SHAKSPERE.

1. Analyse the above passage as far as 'correct him'; and parse the words in italics.

Sentence	Kind of Sentence.	Subject.	Predicate.	Object.	Extension.
(*a*) O, my Lord, press not a falling man too far	principal	(*thou*) my lord	press not	a falling man	too far (*deg.*)
(*b*) 'Tis virtue	Subord of reason to (*a*)	it	is virtue		
(*c*) His faults lie open to the laws;	principal	His faults	lie		open to the laws (manner)
(*d*) Let them correct him.	prin. in illative co-ord. with (*c*)	('*thou*)	let	them (dir) correct him (indirect)	
(*e*) (*Let*) not you (*correct him*)	prin. same as (*d*)	(*thou*)	(*let*) not	you (direct) (*correct him*) (indirect)	

Parsing.

Lord—noun proper, mas., sing., vocative case, or nom. of address.
let—trans. verb., irreg. *let, let, let;* imper. 2nd pers. sing. agreeing with (thou) or plur. with (you).
correct—trans. reg. verb, pres. infinitive gov. by *let.*
so—adv. of degree mod. *little.*
little—adj. predicative of *him.*
of—prep. gov. obj. case *self.*
his—poss. adj. limiting *self.*
great—adj. qualifying *self.*
self—noun neut. sing. obj. by *of.*

2. Give the full meaning of the passage:—

My Lord be not too harsh with a man who is on the road to ruin, for gentleness towards him would be a virtue. Let the wrong that he has done be judged by the laws, for they should deal out his punishment, and not you. I am grieved to see that he has lost so much of his former greatness, both of place and of principle.

3. Give examples of the various ways in which the subject of a sentence may be extended.

The subject may be enlarged by—

1. One or more adjectives :—*This old, red* book is mine.
2. Words in apposition :—Garfield, *the President*, was assassinated.
3. Participles or participial phrases :—He, *having failed*, left the town.
4. A prepositional phrase :—The fear *of man* is a snare.
5. A noun or pronoun in the possessive case :—*Harry's* uncle has come.
6. The gerundial infinitive :—Bread *to eat* was scarcely to be got.

Geography.

1.—Draw a full map of Australia. Insert the lines of latitude and longitude, and explain why they are useful in drawing a map.

The lines of latitude and longitude are useful in fixing the positions of places exactly as they are on the earth itself. They form, in fact, a complete set of guiding lines for drawing a correct representation of parts of the earth.

2. Give notes of a lesson on 'The Isthmus of Suez and the Red Sea.'

Notes of a lesson on 'The Isthmus of Suez and the Red Sea.'

I. *Where located.*—The isthmus forms the connection between Asia and Africa; Red Sea lies between them; the isthmus separates the Red Sea from the Mediterranean, while the Red Sea, by means of the Suez Canal, connects the waters of the Mediterranean with those of the Arabian Sea.

II. (*a*) *Description of Isthmus.*—Seventy-two miles broad; surface generally sandstone, which has in many places been ground to sand; not level, but having many depressions occupied by salt marshes or lakes, the most notable being Abu Ballah Lake, Lake Temsah, and the Bitter Lakes; it is almost entirely destitute of drinkable water; ancient canal used to connect the waters of the Nile with the Red Sea. The well-known *Suez Canal*, constructed by M. de Lesseps, is just 100 miles long; large artificial harbour at upper end, of 500 acres. At Port Said, from which town canal passes through Lake Menzaleh, a shallow swamp, then through Kantara cutting three miles, through Ballah Lake, through a portion of a plateau eight miles long, through Lake Temsah, where stands the flourishing town of *Ismailia*, through nine miles of dry land, through the Bitter Lakes, through a further portion of seventeen miles of land and dried-up lakes, where it reaches *Suez*, where all the necessary piers, docks, etc., have been constructed. And we now have a

III. *Description of the Red Sea.*—A branch of the Indian Ocean, connected with it by Straits of Babelmandeb, from which to the Isthmus of Suez it is 1,400 miles; breadth is nowhere more than 230 miles; at north end are two branches called Gulfs of Suez and Akaba, separated by the Peninsula of Sinai.

Character.—Very deep, in some places 230 fathoms; navigation difficult on account of numerous reefs and sandbanks; subject to sudden changes of wind, and S.E. monsoon blows for eight months, and the N.W. during the remainder of the year; said to be named on account of *red animalcula* found at certain seasons in the many coral reefs which run parallel to the shore.

History and use.—First mentioned in connection with the Israelites; in time of Solomon the advantages of its navigation seem to have been well understood; discovery of passage to India nearly destroyed for a time the commerce and navigation of the Red Sea, but by the construction of the fore-mentioned canal English steam packets are now constantly passing and repassing. By the purchase of the Khedive's shares in the Suez Canal the British Government secured in great measure a short water-way to their Indian dominions.

SECOND PAPER.

History.

One hour allowed for Females.
Two hours and a half allowed for Males

1. What is meant by the Restoration of the Stuarts. How was it brought about?

By the Restoration of the Stuarts is meant the abolition of the government of the Commonwealth and the return to a Monarchy by the recall of Charles II. to the throne of England, 1660.

It was brought about in the following way, The military government which the officers under General John Lambert had set up in London not only dissatisfied Monk, the Commander of the English army in Scotland, but the fleet, the people, and even the soldiers. Fairfax, co-operating with Monk, mustered his friends, and so far were things successful that Monk on his return to London declared for a free Parliament, an announcement that was received with the greatest joy. The members 'purged' by Pride took their seats, and Parliament, after issuing writs for a general election, decreed its own dissolution. The new Parliament, called a *Convention*, met 25th April, 1660. Monk had been keeping Charles well informed of all that was going on, and the latter issued a Declaration from *Breda*. Eight days after the issue of this Declaration, *Charles II.* was proclaimed King, and on May 29, amid the greatest enthusiasm, he returned to London, which event has been styled the *Restoration of the Monarchy*

2. When and how did England win Canada?

During the Seven Years' War, in September, 1759, *James Wolfe*, a young general of Pitt's choosing, having scaled the almost inaccessible heights on which *Quebec* stands, surprised the French under *Montcalm*, and completely defeated them. Both generals were killed, Wolfe falling in the moment of victory. Five days after, Quebec capitulated, and as this fortress was the key to Canada, within a year the colony was in the hands of the British.

3. Who reigned immediately before our Queen? What famous Acts of Parliament passed in that reign in reference to Reform and to Slavery?

William IV. reigned immediately before our Queen. During his reign a Reform Bill was passed, June 7, 1832, by which fifty-six boroughs were disfranchised, and forty-three new ones, together with thirty county constituencies, were created. A £10 householder got the right of voting in boroughs, and the right in counties was extended from forty-shilling freeholders to copyholders, leaseholders, and tenants of premises of certain values.

In August, 1833, an Act for the Abolition of Slavery was passed, by which twenty millions sterling were to be paid by this country in compensation to slaveholders in the British Dominions for setting free their slaves.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Harpsichord*.

Write, in small hand, as a specimen of copy-setting, *Poised in mid air upon the giddy mast.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

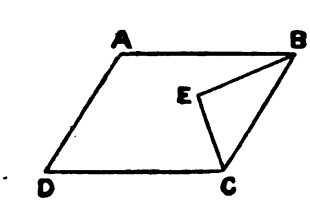
[All generally understood abbreviations for *words* may be used.]

1. If a straight line fall upon two parallel straight lines, it makes the alternate angles equal to one another; and the exterior angle equal to the interior and opposite upon the same side; and likewise the two interior angles upon the same side together equal to two right angles.

See Prop. XXIX., Bk. I.

2. Straight lines bisecting two adjacent angles of a parallelogram are at right angles to one another.

Let ABC, BCD two adjacent angles of the parallelogram ABCD, be bisected respectively by the straight lines BE, CE.



By I. 28 the angles ABC, BCD are together equal to two right angles, and therefore EBC, ECB being less than two right angles, EB, EC will meet. Let them meet in E; then EBC, ECB are together equal to one right angle, and since the three angles of every triangle are together equal to two right angles, (I. 32) therefore the remaining angle BEC must be a right angle. Q. E. D.

3. Triangles upon equal bases and between the same parallels are equal to one another.

See Prop. XXXVIII. Bk. I.

Algebra.

1. Prove the rule for finding the least common multiple of two expressions. Find it for x^2-3x+2, x^2-5x+6, and x^2-4x+3

(*a*) Rule to find the L. C. M. of two expressions :—*Divide the product of two expressions by their G. C. M.* Proof:—Let A and B denote the two expressions, and D their greatest common measure. Suppose $A=aD$ and $B=bD$. Then from the nature of he greatest common measure a and b have no common factor, and therefore their least common multiple is ab. Hence the expression of lowest dimensions which is divisible by aD, and bD is abD.

And $abD=Ab=Ba=\frac{AB}{D}$. Hence the rule given above; otherwise, *Divide either expression by the G. C. M., and multiply the other by it.*

$$\begin{aligned}(b)\ (1)\ x^2-3x+2 &= (x-2)(x-1)\\ (2)\ x^2-5x+6 &= (x-2)(x-3)\\ (3)\ x^2-4x+3 &= (x-1)(x-3)\\ \therefore \text{ the L. C. M.} &= (x-2)(x-3)(x-1)\\ &= (x^2-3x+2)(x-1)\\ &= \underline{x^3-4x^2-x-2.}\end{aligned}$$

2. Solve the equations :—

$$(1)\quad \frac{b^2}{x}+c=\frac{a^2}{c}$$

$$(2)\quad \frac{1}{x-1}-\frac{2}{x+7}=\frac{1}{7(x-1)}$$

(1) Clearing of fractions $b^2c+c^2x=a^2x$

$$c^2x-a^2x=-b^2c$$

$$x=\underline{\frac{b^2c}{a^2-c^2}}$$

(2) Multiply each side by $7(x-1)(x+7)$.

$$7x+49-14x+14=x+7$$

$$7x-14x-x=7-49-14$$

$$8x=56$$

$$x=\underline{7}$$

3. A and B have two guineas between them, and if A give to B one shilling for ever penny B has, A will then have ten shillings less than B; how much had each at first?

Let x = B's money in shillings
then $12x$ = " " pence
and $42-x$ = A's " " shillings
then according to terms of problem

$$(42-x)-12x=(12x+x)-10$$

$$42-13x=13x-10$$

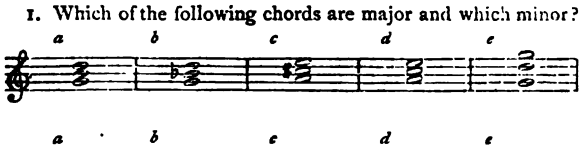
$$26x=52$$

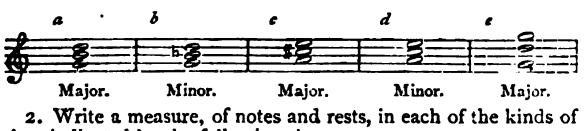
$x=$ 2s. B's money and $\therefore$ 40s. A's.

Music.

A quarter of an hour allowed for this Paper.

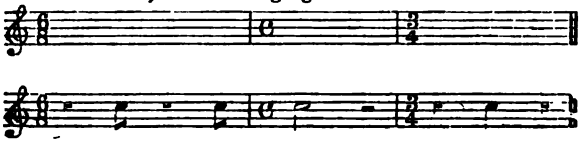
1. Which of the following chords are major and which minor?



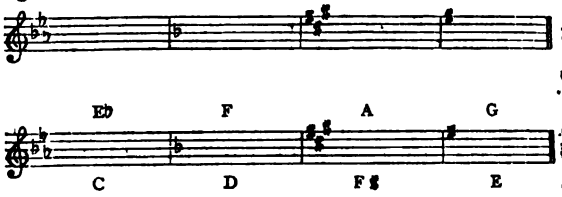


Major. Minor. Major. Minor. Major.

2. Write a measure, of notes and rests, in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* 1st *May,* 1878; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Two hours and a-half allowed.

Arithmetic.

MALES.

1. What capital sum laid out at $5\frac{1}{2}$ per cent. per annum simple interest, on the 1st of January, would amount to £1250 on the 29th of September in the same year, both days being included?

No. of days from Jan. 1st till 29th Sept.
$=(31+28+31+30+31+30+31+31+29)=272$

Interest of £100 for 272 days @ $5\frac{1}{2}$ p. c. per annum
$=£\frac{1496}{365}=4\frac{36}{365}$

amount of do., for do. $=£104\frac{36}{365}$

$\therefore £104\frac{36}{365} : £100 :: £1250$: principal required

$$£\frac{1250\times 36500}{37996}=£\frac{11406250}{9499}=\underline{£1200\ 15s.\ 8\frac{1818}{9499}d.}\quad \text{Ans.}$$

2. What is meant by 'insurance'?

What is the insurance on £7285 at £2 7s. 6d. per cent.? And if the rate of insurance be £1 6s. 4d. per cent., for what sum is an individual insured who pays an annual premium of £29 10s.

(*a*) Insurance is a contract by which one party on being paid a certain sum or *premium* by another party on property which is subject to risk, undertakes, in case of loss to make good to the owner the value of the property. The premium is usually charged at so much per cent.

(*b*) £100 : £7285 :: £$2\frac{1}{2}$: amt. required

$$\frac{£19\times 7285}{8\times 100}=£\frac{1384\cdot 15}{8}=\underline{£173\ 0s.\ 4\frac{1}{2}d.}\quad \text{Ans.}$$

(*c*) 26s. 4d. : £29 10s. :: £100 : sum insured.

$$£\frac{100\times 7080}{316}=£\frac{177000}{79}=\underline{£2240\ 10s.\ 1\frac{1}{2}d.}\quad \text{Ans.}$$

3. If I lay out £1270 in the 3 per cents. at $92\frac{1}{2}$, and sell out after allowing the dividends to accumulate for 2 years, and then find myself the richer by £147 10s., at what price do I sell out? Give your answer in decimals to four places.

$$\text{Total increase of capital} = £147\tfrac{1}{2} = £147\tfrac{10}{20}$$

$$\text{Two years' dividends}\left(\frac{1270\times 3}{92\frac{1}{2}}\right)\times 2=£\tfrac{8}{37}\tfrac{8}{0}=82\tfrac{1}{2}\tfrac{6}{0}=82\tfrac{12}{20}$$

Difference of capital to be made by sale $65\frac{9}{20}$

$\therefore £1270 : £(1270+65\frac{9}{20}) :: £92\frac{1}{2}$: selling price required

$$\frac{£92\cdot 5\times 1335\frac{9}{20}}{1270}=£\frac{18\cdot 5\times 98799}{254\times 74}=\frac{\cdot 5\times 98799}{254\times 2}=$$

$$£\frac{49399\cdot 5}{508}=\underline{£97\cdot 2431+}\quad \text{Ans.}$$

A bankrupt's stock was sold for £520 10s. at a loss of 17 per cent. on the cost price. Had it been sold in the ordinary course of trade it would have realized a profit of 20 per cent.; for how much money below the trade price was it sold?

(*a*) 83 : 100 :: £520·5 : $\frac{520\cdot 5\times 100}{83}$ cost price.

(*b*) $\therefore$ 100 : 120 :: £$\frac{52050}{83}$: trade price.

$$£\frac{52050\times 120}{83\times 100}=£\frac{62460}{83}=£752\ 10s.\ 7\tfrac{12}{83}d.$$

or briefly

	£	s.	d.	
83 : 120 :: £520·5 :	752	10	$7\frac{12}{83}$	trade price.
subtract price of stock =	520	10	0	
$\therefore$ the amnt. below trade price =	232	0	$7\frac{12}{83}$.	Ans.

FEMALES.

1. What sum of money put out at 10 per cent. will produce £12 10s. for interest in 10 days?

£10 : £12·5 } ∴ :: £100 : Sum required.
10 days : 365 days }

$\frac{£100 \times 12{\cdot}5 \times 365}{10 \times 10} = £365 \times 12\frac{1}{2} = \underline{£4562\ 10s.}$ Ans.

2. Simplify $3\frac{3}{4} + 1\frac{1}{2} + 13\frac{7}{10} + \frac{1}{20}$

$3\frac{3}{4} = 3\frac{1}{4} = 3\frac{5}{20}$
$1\frac{1}{2} = 1\frac{10}{20}$
$13\frac{7}{10} = 13\frac{14}{20}$
$\frac{1}{20}$
Sum $= 17\frac{30}{20} = \underline{19\frac{1}{10}}$. Ans.

3. A man collecting rents at a commission of $4\frac{1}{2}$ per cent. paid, after deducting his commission, £1482 3s. 9d. What amount of rent did he collect?

After deducting commission there remains $\frac{95\frac{1}{2}}{100} = \frac{765}{800} = \frac{153}{160}$

∴ Amount of rent collected = £1482 3s. 9d. $\times \frac{160}{153} =$

$= \frac{£237150}{153}$

i.e. £1550. Ans.

4. A woman bought a certain number of eggs at the rate of 4 for 3d., and sold them at the rate of 5 for 4d., by which she made a profit of 2s. How many eggs did she buy?

(*a*) Selling price of each = $\frac{4}{5}$d.
Buying ,, ,, = $\frac{3}{4}$d.
∴ the gain on each $= \frac{16-15}{20}$d. = $\frac{1}{20}$d.

(*b*) $\frac{1}{20}$d. is gained by sale of 1 egg
∴ 1d. ,, ,, 20 eggs
and 24 ,, ,, 480 eggs. Ans.

Grammar.

'Tell me not in mournful numbers,
Life is but an empty dream!
For the soul is dead that slumbers,
And things are not what they seem.'

1. How many kinds of sentences are there in the above? Point them out, and analyse fully the noun sentence.

The sentences in the above are as follows:—

(1) Tell me not in mournful numbers (*Principal*)
(2) Life is but an empty dream (*noun sent. subord. to* (1))
(3) For the soul is dead (Prin. sent. caus. to (1) and (2))
(4) That slumbers (adj. sent. subord. to (3))
(5) And things are not (*the things*) (Prin. cop. with (3) and caus. to (1) and (2))
(6) What they seem (adj. sent. subord. to (5)).

Analysis of Noun Sentence.

(*that*)	... ...	*Connective.*
Life...	... ...	*Simple subject.*
is	... ...	*Incomplete predicate.*
but an empty dream	...	*Completion of predicate.*

2. Comment on *what* and *but* in the above passage.

What in the above is a relative with its antecedent understood. It is generally called a *compound relative*, although the word is not compound. Perhaps the better way is to consider it as a simple relative with its antecedent understood. It is used as an adjective, as '*What* kind is it?' and as an interrogative, as '*What* do you say?'

But in such connections as the above is usually considered as an adverb, meaning 'only.' This construction is said to have arisen from the improper omission of a negative. The sentence in full would be 'Life is not a dream, but being, *i.e.*, except being an empty dream.'

But is also an adversative conjunction, as 'John reads, *but* James plays,' a relative 'There is no one *but* (= who not) loves to be praised' and a preposition, as 'They all fled but him.'

3. What are the proper prepositions to use after *differences, agree, averse, compared.*

With *difference* is used *between*, *e.g.* Find the difference between these two numbers.
With *agree* are used *with*, and *to*, *e.g.* I *agree with* you (person). *I agree to* your proposals.
With *averse* is used *to*, *e.g.* I am averse to that proceeding.
With *compared* are used *to*, and *with*, *e.g.* He *compared* anger *to* a fire. He *compared* this picture *with* that.

4. Show in what respects our language affords evidence of the different races which have inhabited this country.

Our language affords evidences of the different races whic have inhabited this country from the traces of their language found in every-day words, but especially in the *names of places:* For example we have traces

Of the *Celts* in *Kent, Avon, Ouse, Dee, Derwent, Pen-y-gant, etc.*
Of the Romans in *Stratford, Lincoln, Chester, Doncaster, Tadcaster.*
Of the Danes in *Grimsby, Scawfell, Stockgill Force, Langholm, Wansbeck.*

French had a greater hold on the upper classes; and in Law Courts to this day, the royal assent to Bills is announced in Parliament in the French words *Le Roi*, or *La reine le veut.* The *O Yes* of the Crier is a relic of the French *ouies!* hear!

Geography.

1. Give notes of a lesson to an advanced class on 'The lines of latitude and longitude, as shown on a globe, their meaning and their usefulness.'

Draw a map of South America, with the lines inserted, and refer to this map at each point of the lesson.

Notes of a lesson on 'Latitude and Longitude, as shown on a globe.'

Meaning—Examine a globe—lines are found drawn from top to bottom, and round it—the important one round the middle, named the *Equator*—8 lines parallel to that above and 8 below—all circles, getting smaller as they near the poles—*Explain why*—called parallels of latitude show in degrees, minutes, seconds (*'division of circles' to be explained*), the distance of places reckoned in degrees, 1° to 90° from Equator—places above being in north latitude—places below in south latitude; look for these remarkable parallels, tropics of Cancer and Capricorn, Arctic and Antarctic circles (*these terms to be explained*).—Lines drawn from N. to S., called meridians (*why?*) all same size—all great circles—(*why?*) being all the same, a special one chosen to reckon from, called a '*first meridian*'—places reckoned at so many degrees, etc. E. or W. of first meridian, till they meet at 180°—the British choose for their first meridian, the one passing through Greenwich Observatory; the French, the one through Paris. Other countries, generally the one passing through the capital. (The *Knot*, geographical or nautical mile, to be explained as one minute or 21,600th part of earth's circumference at the equator.)

Usefulness of these lines.—Show that the position of a place cannot be settled by one line; but by the *crossing* of the lines any place can be fixed with the greatest accuracy. Give exercises at first in finding places whose latitude and longitude present little difficulty. Show the *convenience* of these lines in fixing the place of a shipwreck in mid-ocean, and hence a means of filling charts when latitudes and longitudes have been got—the *service* of these cross-lines to the navigator, who with proper instruments, can determine at any time his position in degrees, etc., N. or S. of the equator, and how many degrees, etc., E. or W. of Greenwich. Instance the danger of *losing the reckoning.*

2. Describe fully the islands of Sicily, Iceland, Java, and Madagascar.

Sicily is the largest island in the Mediterranean, separated from Italy by the straits of Messina. It is triangular, in shape, its former name being Trinacria or '*Three-cornered,*' its extreme length being 185 miles, and greatest breadth 120 miles. It is mountainous, the groups extending across the island from N.E. to S.W. Towards the eastern coast rises the detached group of Etna, at whose base lies the plain of Catania, the largest in the island. Few of the rivers flow continuously all the year, and none are navigable. Sicily has only two lakes. The sea around the coast abounds with fish of various kinds, the most

productive fisheries being those of the sardine, anchovy, and tunny. The minerals are numerous, but not very valuable, the most important being sulphur, which has been worked for more than three hundred years. The climate, though hot, is generally delightful; snow is never seen, except on the highest mountains, and the sky in summer is beautifully clear. Its vegetable productions embrace many tropical, as well as European plants, and it was anciently regarded as the granary of Italy. The principal articles of export are the wines of Marsala, sulphur, fruits, and olive-oil. The chief towns are *Palermo*, *Messina*, *Catania*, *Syracuse*, and *Trapani*.

Iceland.—A large island in the North Atlantic Ocean, is 300 miles long and 200 broad. Its surface is rugged and mountainous, its soil barren, and its climate severe. Volcanic eruptions are frequent in many parts, Mount Hecla the chief volcano, of which many eruptions have been recorded. Springs of hot water are numerous, the most famous being the Great Geyser, which throws columns of water 90, 100, and sometimes even 150 feet high. The island is thinly peopled. The people were anciently distinguished in literature, and they are still intelligent, hospitable, and of very simple manners. The chief town is *Reykiavik*.

Java, a large island of the Eastern Archipelago, extends from E. to W. about 600 miles, with an average breadth of 100 miles, and is traversed through nearly its whole length by a range of volcanic mountains, volcanoes being more numerous in this island than in any other country of equal extent in the world. The climate is characterised by great heat in the plains, and by numerous earthquakes and thunderstorms. The range of vegetation is very great, and this is the only island of the great archipelago of which the *teak-tree* is a native. The much-talked-of *upas-tree* grows in its woods, its juices destroying animal life when they enter the system, but otherwise doing no injury to the surrounding vegetation. Java is the granary of the archipelago, rice being the principal grain. Animals comprise tigers, tiger-cats, rhinoceroses, buffaloes, crocodiles, and serpents. The chief towns are *Batavia*, *Samarang*, and *Sourabaya*.

Madagascar, the only large island of Africa, and the sixth largest in the world, is situated in the Indian Ocean, east of the Portuguese possessions, from which it is separated by the broad channel of Mozambique. Its area is about four times that of England. It is divided into a number of small states, which are subject to one sovereign, whose capital is Atananarivo, near the centre of the island. A chain of mountains traverses the island from N. to S. Minerals are plentiful, and coal is used in smelting the iron. Wild animals are few, but they comprise lemurs, a kind of ape peculiar to the island. The chief vegetable productions are medicinal plants, pepper, cotton, indigo, sugar-cane, and tobacco. The language is a branch of a very singular family of languages, exceeding in simplicity and phonetic structure all other languages in the world. For example, most of them have but ten consonants, while none of them allows a syllable to close with a consonant or begin with more than one.

SECOND PAPER.

One hour allowed for Females.
Two hours and a-half allowed for Males.

History.

1. When was Wales incorporated with England, and by whom was Ireland raised to the dignity of a kingdom?

In 1536, under Henry VIII., Wales was incorporated with England, and the English laws and liberties were granted to the inhabitants. Ireland was also brought under a somewhat stronger rule; and in 1542 it was raised to the dignity of a *kingdom*, having been formerly styled only a *lordship*.

2. When was the Habeas Corpus Act passed, and what are its provisions? Is it ever suspended, and with what object?

The *Habeas Corpus Act* was passed 1679, in the reign of Charles II.

The object of this Act was effectually to provide that no man should be long detained in prison on a criminal charge without either the legality of his imprisonment being proved in open court, or his being brought to trial.

In times of great public danger the operation of this Act is sometimes suspended by Parliament giving the Government power for a limited period to imprison suspected persons without bringing them to trial. It is suspended in Ireland at present for eighteen months on account of the very disturbed state of that part of the British Empire.

3. Who was the last Prince Regent? When and under what circumstances did he acquire that position?

The last Prince Regent was George IV., when Prince of Wales. George III. was afflicted with fits of insanity, and at last, about 1811, he permanently lost his reason, from which time his reign may be reckoned as at an end in all but name, the Prince of Wales ruling in his stead as Regent.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Harpsichord*.

Write in small hand, as a specimen of copy-setting, *Poised in mid-air upon the giddy mast.*

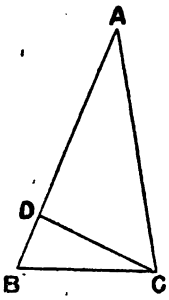
Composition.

Write an account of any book (not a lesson book) which you have recently read with interest.

Euclid.

[All generally understood abbreviations for *words* may be used.]

1. If A be the vertex of an isosceles triangle ABC, and CD be perpendicular to AB, the squares on the three sides are together equal to the square on BD, twice the square on AD, and thrice the square on CD.



By I. 47, the sq. on AC = sqs. on AD, DC, but AB = AC. ∴ the sqs. on AC, CB = 2 sq. on AD, and 2 sq. on DC. Now the sq. on BC is equal to the sqs. on BD, DC. ∴ the sqs. on the three sides AC, AB, BC are equal to the sq. on BD, twice the sq. on AD, and three times the sq. on D. C.—Q. E. D.

2. Let AB be divided into any two parts at C. Then rect. AB, BC = rect. AC, BC, together with sq. on BC.—See Prop. 3, Bk. II.

3. If a straight line be divided into two equal, and also into two unequal, parts, the sqs. on the two unequal parts are together double of the sq. on half the line, and of the sq. on the line between the points of section.—See Prop. 9, Bk. II.

Algebra.

1. Find the value of $\frac{x+y-1}{x-y+1}$ when $x=\frac{a+1}{ab+1}$, $y=\frac{ab+a}{ab+1}$

Substituting for x and y

$$\frac{\frac{a+1}{ab+1}+\frac{ab+a}{ab+a}-1}{\frac{a+1}{ab+1}-\frac{ab+a}{ab+1}+1}=\frac{\frac{a+1+ab+a-ab-1}{ab+1}}{\frac{a+1-ab-a+ab+1}{ab+1}}$$

$$=\frac{2a}{2}=\underline{a}.$$

2. Solve the equations:—

$$(1)\ \frac{3x+2y}{56}=1=\frac{2x+3y}{54}$$

$$(2)\ \frac{x}{x+3}+\frac{x+3}{x}=2\cdot9.$$

(1) $\frac{3x+2y}{56}=1$, or $3x+2y=56$, or $6x+4y=112$

$\frac{2x+3y}{54}=1$, or $2x+3y=54$, or $6x+9y=162$

By subtraction $5y=50$

$y=10$

∴ by substitution $x=\underline{12}$

(2) $\frac{x}{x+3}+\frac{x\times3}{x}=2\cdot9$

Clearing of fractions, $10x^2+10x^2+60+90x=29x^2+87x$
Changing sides, $20x^2-29x^2+60x-87x=-90$
Collecting $9x^2+27x=90$
Dividing by $9x^2+3x=10$
Completing the square, $x^2+3x+2\cdot25=12\cdot25$
Taking root, $x+1\cdot5=\pm3\cdot5$
$x=\pm3\cdot5-1\cdot5=\underline{2 \text{ or } -5}$

3. A man holds some land at £150 a year; he retains 15 acres for his own use, and lets the rest for building at 10s. per acre more than he gave for it. By so doing he just paid his rent. How much land did he let?

Let x = No. of acres; then $£\frac{150}{x}$ = price of 1 ac. in pounds.

„ $x-15$ = No. of acres let; and $£\frac{150}{x} + £\frac{1}{2}$ = increased price of 1 ac.

therefore the equation is $£\left(\frac{150}{x}+\frac{1}{2}\right)\times(x-15)=£150$.

Multiplying and clearing of fractions—

$$x^2+285x-4500=300x$$
$$x^2+285x-300x=4500$$
$$x^2-15x+(7{\cdot}5)^2=4500+56{\cdot}25=4556{\cdot}25$$
$$x-7{\cdot}5=\pm67{\cdot}5$$
$$x=7{\cdot}5\pm67{\cdot}5=75 \text{ acres.}$$

∴ he lets 75 − 15 or 60 acres.

Mensuration.

1. The sides of a right-angled triangle are 11 and 60; prove that the equilateral triangles described on them are together equal to the equilateral triangle described on the hypotenuse.

Hyp. of right-angled triangle $=\sqrt{11^2+60^2}=\sqrt{121+3600}=\sqrt{3721}=61$.

Area of equil. triangle with side 11 $= 11^2\times{\cdot}433 =$ 52·393
„ „ „ 60 $= 60^2\times{\cdot}433 =$ 1558·800

Sum of triangles on sides = 1611·193

Area of equil. triangle with side 61 $= 61^2\times{\cdot}433 =$ 1611·193
= sum of equil. triangles on sides. Q. E. D.

Note.—·433 *is the approximate area of an equilateral triangle whose side is* 1.

2. The circumference of a circle is 24 ft. 9 in.; express its diameter as the fraction of a chain.

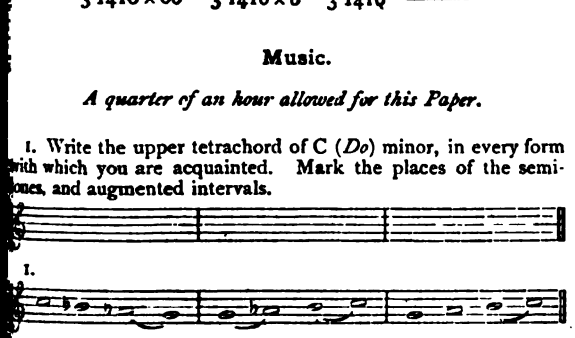
Diameter of circle $=\frac{\text{circumference}}{3{\cdot}1416}=\frac{24{\cdot}75 \text{ ft.}}{3{\cdot}1416}$ which expression reduced to the fraction of a chain (66 ft.) is

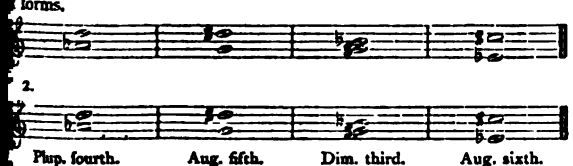
$$\frac{24{\cdot}75}{3{\cdot}1416\times66}=\frac{2{\cdot}25}{3{\cdot}1416\times6}=\frac{{\cdot}375}{3{\cdot}1416}=\underline{{\cdot}11936.}$$

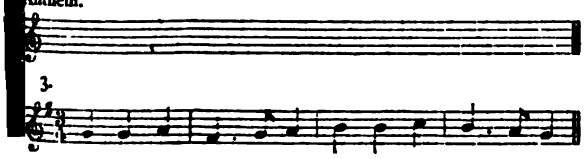
Music.

A quarter of an hour allowed for this Paper.

1. Write the upper tetrachord of C (*Do*) minor, in every form with which you are acquainted. Mark the places of the semitones, and augmented intervals.



2. Write, under each of the following pairs of notes, the name and quality (major, perfect, diminished, or other) of the interval it forms.

Flup. fourth. Aug. fifth. Dim. third. Aug. sixth.

3. Write, from memory, the first four measures of the National Anthem.

Matriculation Chemistry.

BY E. W. V. VOLCKXSOM,

Lecturer on Chemistry at St. Gregory's College, Downside, Bath.

66. The preparation and properties of **oxygen** gas. *July*, 1846.

Give an account of the properties of one of the principal constituents of the atmosphere, namely, **oxygen**. *July*, 1850.

Give an account of the preparation and describe the properties of **oxygen** gas. *July*, 1854.

The preparation of oxygen gas has been given in the previous numbers. We shall now give its properties.

Oxygen is a colourless invisible gas, possessing neither taste nor smell. It exists free in the atmosphere, of which it constitutes about one-fifth in bulk. It forms eight-ninths by weight of water and nearly half the weight of the solid earth. It was till lately believed that it was impossible to reduce it to the liquid state, but two Swiss chemists* have recently shown that notion to be false. **Oxygen** is a little heavier than air. Its specific gravity compared with air is 1·10563. **Oxygen** is necessary to animals in breathing and is essential in all cases of ordinary combustion: it is therefore said to be *a supporter of combustion.* Bodies which burn in the air burn in **oxygen** with greatly increased splendour. If a taper be blown out and introduced into the gas while the wick remains red-hot, it is instantly rekindled. This effect is highly characteristic of **oxygen**, there being but one other gas, **nitrous oxide** (N_2O), which possesses the same property. Lastly, all the elements with the exception of fluorine form compounds containing **oxygen**.

67. How many cubic centimetres of **oxygen** are contained in 100 cubic centimetres of **air**, and how many cubic centimetres of **hydrogen** would be burned by this quantity of **oxygen**? *June*, 1869.

It is found from careful analysis of air that in 100 parts of **air** there are 21 parts by volume of **oxygen** and 79 parts by volume of **nitrogen**. Hence in 100 cubic centimetres of **air** there are 21 cubic centimetres of **oxygen**.

With regard to the second part of the question, we know that **hydrogen** is completely burned by **oxygen** in the proportion by volume of 2 to 1. Hence to burn 21 cubic centimetres of **oxygen**, 42 cubic centimetres of **hydrogen** will be required.

68. How would you extract **oxygen** from **water**? Explain your process. *Jan.*, 1873.

Water is decomposed into **oxygen** and **hydrogen** by electricity. The equation for the reaction would be:—

$$\underset{\text{water.}}{2H_2O} = \underset{\text{hydrogen.}}{2H_2} + \underset{\text{oxygen.}}{O_2}$$

For the explanation of the process see No. 98 in Chapter III.

Also if a stream of **chlorine** be passed through a flask of boiling **water** it will escape by the exit-tube

* Pictet and Caillet.

saturated with vapour of **water**. If the exit-tube be connected with a glass tube filled with fragments of glass or pumice heated to redness by a furnace, a chemical change takes place by which a mixture of oxygen and hydrochloric acid is produced; and if this mixture passes through the water of the pneumatic trough, the hydrochloric acid is dissolved and the **oxygen** may be collected. The following represents the reaction.

$$\underset{\text{water.}}{2H_2O} + \underset{\text{chlorine.}}{2Cl_2} = \underset{\text{hydrochloric acid.}}{4HCl} + \underset{\text{oxygen.}}{O_2}$$

69. How is **oxygen** distinguished from **nitrogen** and from **protoxide of nitrogen**?—*Jan.*, 1863.

A given sample of gas is found to have the property of kindling a glowing splint of wood. Enumerate the reactions by which you would decide whether it consists of **oxygen** or **nitrous oxide**. *Jan.*, 1870.

How would you distinguish **nitrous oxide** from **oxygen**? *June*, 1874.

Oxygen would be instantly distinguished from **nitrogen** by lowering into the vessel containing the gas a freshly extinguished taper. If the vessel contains **oxygen** the taper will be instantly rekindled, whereas if the gas be **nitrogen** the red-hot wick or even a lighted taper will be at once extinguished.

Now this same test will be of no avail with regard to **protoxide of nitrogen** (N_2O), because **oxygen** and **protoxide of nitrogen** have in common the property of strongly supporting combustion. **Nitric oxide** forms brown fumes with **free oxygen**, and *not* with any other gas. Therefore, to distinguish **oxygen** from **protoxide of nitrogen** (nitrous oxide), pass into both a little nitric oxide. It will produce brown fumes in the **oxygen** and *not* in the **nitrous oxide**.

Also, a solution of **potassic pyrogallate** absorbs **free oxygen**, becoming black at the same time. If, therefore, a few drops of the solution of pyrogallate of potash be shaken in jars of the two gases, it will become black in the **oxygen** and *not* in the **nitrous oxide**.

70. How much **oxygen** is contained in 10,000 grains of **potassic dichromate** ($K_2Cr_2O_7$)? K = 39; O = 16; Cr = 52·5. How much **oxygen** is given off when the same quantity of the salt is heated with an excess of oil of vitriol? *June*, 1865.

Potassic dichromate:

$K_2 = 2 \times 39 = 78$
$Cr_2 = 2 \times 52{\cdot}5 = 105$
$O_7 = 7 \times 16 = 112$

295 = molecular weight

In 295 parts of $K_2Cr_2O_7$ there are 112 parts of O

$\therefore$ in 10,000 do. $\frac{112 \times 10{,}000}{295} = 3796{\cdot}61$ do.

$\therefore$ the first answer is 3796·61 grains.

The equation representing the reaction is:—

$$\underset{\text{potassic dichromate.}}{2K_2Cr_2O_7} + \underset{\text{hydric sulphate.}}{10H_2SO_4} = \underset{\text{hydric potassic sulphate.}}{4KHSO_4} + \underset{\text{chromic sulphate.}}{2Cr_2(SO_4)_3} + \underset{\text{water.}}{8H_2O} + \underset{\text{oxygen.}}{3O_2}$$

i.e., two molecules of potassic dichromate containing 14 atoms of oxygen yield 6 atoms of **oxygen**, which is three-sevenths of the contained oxygen, that is,

$\frac{3}{7}$ 3796·61 = 1627·12.

$\therefore$ the second answer is 1627·12 grains.

71. Name the substances which are formed when **carbon**, **hydrogen**, **phosphorus** and **sulphur** respectively are burned in an excess of **oxygen**. *June*, 1865.—*June*, 1867.

When **carbon** is burned in an excess of **oxygen**, **carbonic dioxide** is formed:—

$$\underset{\text{carbon.}}{C} + \underset{\text{oxygen.}}{O_2} = \underset{\text{carbonic dioxide.}}{CO_2}$$

When **hydrogen** is burned in an excess of **oxygen**, **water** is formed:—

$$\underset{\text{hydrogen.}}{2H_2} + \underset{\text{oxygen.}}{O_2} = \underset{\text{water.}}{2H_2O}$$

When **phosphorus** is burned in an excess of **oxygen**, **phosphoric pentoxide** is formed:—

$$\underset{\text{phosphorus.}}{P_4} + \underset{\text{oxygen.}}{5O_2} = \underset{\text{phosphoric pentoxide.}}{2P_2O_5}$$

When **sulphur** is burned in an excess of **oxygen**, **sulphuric dioxide** is formed:—

$$\underset{\text{sulphur.}}{S_2} + \underset{\text{oxygen.}}{2O_2} = \underset{\text{sulphur dioxide.}}{2SO_2}$$

72. A watch-spring is burned in a closed vessel of **oxygen**. State (*a*) whether the weight of the bottle and its contents is affected by the combustion; (*b*) what is the nature of the product formed by the combustion; (*c*) whether the grey, metallic-looking globules found at the bottom of the bottle after the experiment consist of metallic iron; (*d*) whether the whole of the oxygen originally filling the bottle is still present, and, if so, in what form. *January*, 1874.

A steel watch-spring, having a bit of lighted amadou (*German tinder*) fixed to its extremity, when introduced into a vessel of oxygen gas exhibits a most beautiful phenomenon of combustion. The **oxygen** here combines with the iron, and the heat evolved in combination is so great that the fused globules of black iron oxide (Fe_3O_4), after falling through half an inch of water, fix themselves in the plate in which the jar stands.

(*a*) The weight of the bottle and its contents is not affected by the combustion.

(*b*) Black oxide of iron (Fe_3O_4), known as magnetic oxide of iron.

(*c*) No; they consist of oxide of iron, (Fe_3O_4).

(*d*) Yes, it is all present; but a part may be free, and the remainder combined with iron.

73. Why do you consider two atoms of **hydrogen** to be equivalent to one atom of **oxygen**? *January*, 1872.

Sodium, when acted upon by an excess of water, sets free some of the **hydrogen** of the water, and the remainder of the constituents of the water goes to form **sodic hydrate**; thus:—

$$\underset{\text{Sodium.}}{Na} + \underset{\text{water.}}{H_2O} = \underset{\text{sodic hydrate.}}{NaHO} + \underset{\text{hydrogen.}}{H}$$

Now, by heating the **sodic hydrate** till it fuses, and adding an excess of **sodium**, the remainder of the **hydrogen** of the water is liberated and **sodic oxide** is formed, thus :—

$$Na + NaHO = Na_2O + H$$

Sodium. sodic hydrate. sodic oxide. hydrogen.

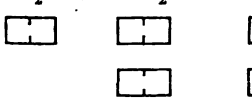
It is found, by measurement, that these two liberated quantities of **hydrogen** are equal; therefore, in water there are two atoms of hydrogen, because no one has yet expelled it in more than two equal portions. The **oxygen** cannot be removed in parts, but all at once: we therefore say that water contains one atom of **oxygen** to two atoms of **hydrogen**.

Now, **hydrogen** combines with **chlorine**, atom with atom, since in their compound—hydric chloride—if the hydrogen or chlorine be replaced by another element, it is all replaced all at once and not by parts. This means that one atom of **chlorine** is equivalent to one atom of **hydrogen**. If in any compound chlorine replaces oxygen, two atoms of chlorine always replace one atom of oxygen; therefore one atom of **oxygen** is equivalent to two atoms of **chlorin**, and therefore also to two atoms of **hydrogn**.

74. In what proportion by volume does **oxygn** combine with each of the following gases, viz., hydrogen, carbonic oxide, marsh gas, and olefiant gas? *June*, 1865.

Combination with **hydrogen**:—

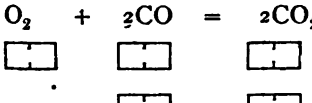
$O_2 + 2H_2 = 2H_2O$.



; *i.e.*, 1 vol. : 2 vols.

Combination with **carbonic oxide**:—

$O_2 + 2CO = 2CO_2$



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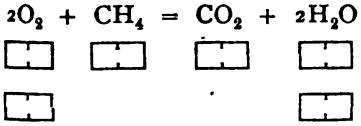
Combination with **marsh gas**:—

$2O_2 + CH_4 = CO_2 + 2H_2O$



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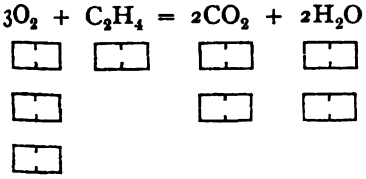
Combination with **olefiant gas**:—

$3O_2 + C_2H_4 = 2CO_2 + 2H_2O$



; *i.e.*, 3 vols. : 1 vol.

75. Describe how you would prepare pure **oxygen**, and give an outline of the leading properties of this element. *January*, 1871.

The answer to the first part of this question will be found in No. 65, and that to the second part in No. 66.

76. **Oxygn** is said to be a permanent gas and a great supporter of combustion. Illustrate each statement by a description of one or two experiments. *June*, 1872.

The term permanent gas is *generally* used in contradistinction to a readily condensible vapour. That **oxygen** is a permanent gas, that is to say impossible to be liquefied by any means at present at our disposal, has been proved to be false by two famous Swiss chemists, only a short time ago.

That **oxygen** is a supporter of combustion is easily proved from the following facts. If a glowing wood-splint be plunged into a vessel of oxygen it at once bursts into flame. A candle and a fire burn in air by virtue of the oxygen which the air contains. If a candle be burned in a closed glass vessel it will continue alight for a short time, and will then be extinguished because all the oxygen has been used.

77. Describe the preparation of **oxygen** from **potassic chlorate**. How many ounces of oxygen can be obtained from 115 ounces of potassic chlorate? *January*, 1879.

The first part of this question has been answered in No. 60. The equation representing the reaction is :--

$$2KClO_3 = 2KCl + 3O_2$$

Potassic chlorate. potassic chloride. oxygen.

$$245 = 149 + 96$$

Thus we have—

$\therefore$ 245 ozs. of potassic chlorate yield 96 ozs. of oxygen,

$\therefore$ 1 " " $\frac{96}{245}$ " "

and 115 " " $\frac{96 \times 115}{245}$ " "

$= 45{\cdot}06$ ozs.

78. Explain, by means of symbols, the decomposition of **mercuric oxide** by heat. *June*, 1879.

Mercuric oxide is decomposed by heat into its two elements, **mercury** and **oxygen**, according to this equation :—

$$2HgO = 2Hg + O_2$$

Mercuric oxide. mercury. oxygen.

79. How would you distinguish **oxygen** from common air? *June*, 1867.

A taper, with the wick red-hot, will burst into flame in **oxygen**, but not in air. **Nitric oxide** forms, with free oxygen, brown fumes, which are readily soluble in water. If, therefore, a few bubbles of that gas are passed into a jar containing air and placed over a pneumatic trough, brown fumes arise. These are at once dissolved in the water, which rises in the jar one-fifth of the height. If the jar contain pure oxygen, the water will rise nearly to the top.

Instead of nitric oxide and water, a solution of **pyrogallate of potash** or a stick of phosphorus may be used in a similar manner.

80. Name the substances which are formed when carbon, hydrogen, sulphur and phosphorus are respectively burned in an excess of **oxygen**. Which of the following bodies can be burned in oxygen :—Sulphur, nitrogen, coke, sulphurous acid, wax, iodine, chlorine, and ammonia? *June*, 1867.

For the solution of the first part of the question see No. 71.

With regard to the second part, sulphur, coke, wax, and ammonia can be burned in **oxygen**; the others cannot.

—o—

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

(1) Add together ninety-seven, eight hundred and seventy-nine, four, nine hundred and nine.
Ans. 1889.

(2) From six hundred and forty-three, take four hundred and thirty-seven. Ans. 206.

(3) Find the difference between one thousand and two hundred and forty-three. Ans. 757.

STANDARD II.

(1) From thirty thousand four hundred and one, take three thousand and ninety. Ans. 27,311.

(2) Divide forty-five thousand and ninety-one by eight. Ans. 5,636—3.

(3) Multiply forty-nine thousand eight hundred and sixty-four by nine. Ans. 448,776.

(4) Multiply thirty-nine thousand and eighteen by forty-seven. Ans. 1,833, 846.

STANDARD III.

(1) Add together eight hundred and fifty-nine thousand nine hundred and fifty-eight pounds seventeen shillings and elevenpence halfpenny, one million pounds and tenpence three farthings, seven hundred and seventeen thousand and seventy pounds nineteen shillings and ninepence farthing, and eight hundred thousand eight hundred and five pounds fifteen shillings and sevenpence farthing. Ans. £3,377,835 14s. 2¾d.

(2) From five hundred thousand five hundred pounds and ten shillings, take fifty thousand and fifty pounds nineteen shillings and a farthing.
Ans. £450,449 10s. 11¾d.

(3) Divide twenty-eight millions, forty-five thousand three hundred and seventy-six, by five hundred and ninety-six. Ans. 47,056.

STANDARD IV.

(1) Multiply twenty thousand and sixty-eight pounds eighteen shillings and elevenpence three farthings by one hundred and twenty-six.
Ans. £2,528,687 11s. 4½d.

(2) Reduce two tons, fifteen cwt., 2 qrs., fifteen pounds, fifteen ozs. to drams. Ans. 1,595,376 drams.

(3) 36 men are sent to mow a field of six acres, two roods, thirty-six poles, twenty-three yards; how many square yards should each man mow?
Ans. 904 sq. yds., 7 sq. ft.

STANDARD V.

(1) Find by practice the value of 6550 at 7s. 10¼d. Ans. £2,572 4s. 9½d.

(2) 19 days, 7 hours, 24 minutes at £5 5s. per day of 24 hours. Ans. £101 7s. 4½d.

(3) Make out this bill in proper form :—
18 gals. of beer at 2¼d. per pint.
5 pints of porter at 2s. 6d. a gallon.
6½ dozen claret at 18½d. per bottle.
21 gals of sherry at £26 15s 6d. per hogshead of 63 gals. Ans. £16 7s. 3¾d.

(4) If the rent of 100 acres be £157 10s., how much should I pay for 50 acres? Ans. £78 15s.

STANDARD VI.

(1) A servant's wages are £11 a year (365 days). If she leaves at the end of 31 weeks and 2 days, how much ought she to receive? Ans. £6 12s.

(2) If 24 horses plough 11 acres in 5 days, how many horses would be required to plough 33 acres in 36 days? Ans. 10 horses.

(3) Add $\frac{5}{6} \times 3\frac{1}{6}$, $\frac{5}{6} \times 1\frac{3}{5}$, $\frac{7}{12} \times 4\frac{4}{9}$, and from the sum of these take $6\frac{1}{27}$. Ans. $\frac{1}{10\,5}$.

(4) Multiply 10·375 by ·0074, and subtract the product from ·76775. Ans. ·690975.

(5) Subtract ·05625 of a pound from ·05 of a guinea. Ans. ½d.

Grammar.

STANDARD IV.

(1) Parse :—
(*a*) What answer will you give this base man?
(*b*) Then long may the oak and ivy stand.

STANDARD V.

(1) Parse and analyse :—
(*a*) Sons of the ocean isle, where rest your mighty dead?
(*b*) Up! up! let us a voyage take.

(2) Parse the words underlined :—
The ground on which we stood was wet.

(3) Analyse :—
Here is our house.

STANDARD VI.

(1) Parse and analyse :—
(*a*) Nothing can be taken out of a bag that was not first put in.
(*b*) I can give the loser leave to chide.
Find indirect object; parse *can give*.
Express in different words the meaning.

(2) Write out imperative mood.

Dictation and Composition.

STANDARD I.

above	snow	black	white
cotton	great	large	square
silk	watch	fine	round
glove	chain	body	water
rain	hand	dinner	money

STANDARD II.

I have heard a story of a man who set out on a long journey to a town. He saddled his horse, and on looking at its feet, he noticed that one of the shoes wanted a nail, but he said, 'It does not matter; it's only one.'

STANDARD III.

They choose a clump of trees which stands away from other trees. They see that it is large enough for all their homes, and then they build up at their very top. Here they make a little town of their homes. Through many generations parent and children rooks live in the same place, family connections never being broken.

STANDARDS IV. AND VI.

Write a letter on any of the following subjects:—

(1) The sea.
(2) The finest place you have ever seen.
(3) The animals of England.
(4) The seasons.

STANDARD V.

Write from memory the substance of the passage read to you by the inspector.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers whose name and address we will gladly give.

The Temptation of Job, and other Poems.

By Ellen Palmer. London: Philip and Son, 32, Fleet Street.

Poetry, or what passes under that much injured name, is at present very unpopular amongst us, both with editors and readers; and no wonder if this little book could honestly be made to pass muster as a fair sample of the art divine.

We are unwilling to be hard upon the writer, who as a well-meaning lady (whether matron or spinster we know not) comes forward, not for the first time, as an authoress; but if she will force her 'poems' upon the public, she must abide the critic's honest verdict just as if she were nothing more than a man. We are obliged, then, to state (and we will justify our opinion by extracts) that, considered as 'poetry,' this very bald and clumsy paraphrase of the sublime book of Job is deficient in the first elements of rhyme and rhythm. Take these examples:—

P. 20—

'For though my God should slay me, yet will I trust in Him.
But mine own ways I will maintain, I must maintain to Him:
For my salvation He shall be. No hypocrite shall stand
Before His face; and well I know that I shall understand
My ordered cause, and justified shall be,
When He shall call and I reply, reply, my God, to Thee.'

Again, p. 26—

'And though my body be destroyed by worms, yet I shall see,
See in my flesh, yes, see my God, whom I shall surely see
With mine own eyes. But fear ye then the sword,
For wrath shall bring its punishment, the keen, avenging sword;
And ye shall know, most surely know, know in that latter day
There is a judgment. Thus Job rose to clearer faith that day,'
etc., etc.

Can this 'poetess' be unaware that to rhyme words by themselves is to offend against the first rule of English versification? Rhymes must be similar, but may not be exactly alike. And this fault pervades the whole paraphrase: we have 'guile' and 'beguile,' 'given' and 'forgiven,' 'there' and 'there,' 'arose' and 'arose,' 'heart' and 'heart,' 'said' and 'said,' etc., etc.; in fact, as to the important point of rhyme a fatal deficiency is proved.

And equally is the rhythm of our authoress continually at fault: she changes at will from tens to twelves, sometimes from fourteens to eights, in the most unmelodious and distracting fashion:—

'For well He knows that I have kept His ways, and not
declined
From His commandments. To my mind
His laws were as my food: but who can stay
Or turn Him from His determined way?
Yet, God forbid I own you just. No, for until I die
My righteousness I will hold fast, and my integrity,' etc., etc.

Is this enough? But the whole of Job's Temptation is full of the like inharmonious and faulty rhythm, as also is another so-called 'poem' on Earl Osmond, which, after a wearisome score of pages of equally degraded blank verse, ends thus:—

'Deep, thankful prayers rose upwards, and with a mingled
strain
Of holy fear. Keep me, my heavenly Father, Osmond cried,
Keep me Thine still; with every gift O give Thyself,
Thy Spirit, Lord, to teach me how to use and keep them all!
Make me now poor in spirit, leaning upon Thee
For all my strength; and if in mercy Thou hast laid
The burden of "the Rich man" on my soul, yet I believe I know
That unto Thee all things are possible, and trusting Thee,
I hold my burden as a Talent, held to be restored
In that great day when Rich and Poor shall meet
To hear their final sentence from Thy judgment-seat.'

But it would exercise the patience of Job himself in the present critic and his readers to demonstrate further how hopelessly wanting in the very elements of poetry is this would-be poetess. Neither is this quite the worst we have to say of her. Prosody and accentuation are nowhere, as evidenced in her pronunciations, as thus:—

'While Elĭphaz, to whom his words seemed wild, presumptuous
breath.'
'When Arctūrus and Pleiades beam with soft, sacred light.'
'But Elĭhu, the man of God on whom the Spirit fell.'
'God's pirit spoke by Elĭhu, and eased His servant's pain.'
'Hast thou not taken for thine hope thine uprightness of life?'

Why not 'righteousness'? But it is needless further to expend strength in 'breaking a butterfly on the wheel.'

Let us, for an end, expose a piece of unacknowledged plagiarism, utterly spoiled in the copying. Edgar Poe's 'Bells' is, as all know, a most melodious and graphic poem, whereof, as a sample, we give this stanza:—

'Hear the mellow wedding bells,
Golden bells!
What a world of happiness their harmony foretells!
Through the balmy air of night
How they ring out their delight!
From the molten golden notes,
And all in tune,
What a liquid ditty floats
To the turtle-dove that listens while she dotes
On the moon!
Oh, from out the sounding cells
What a gush of euphony voluminously wells!
How it swells,—
How it dwells
On the Future! how it tells
Of the rapture that impels
To the swinging and the ringing
Of the bells, bells, bells,
To the rhyming and the chiming of the bells!'

There sings the true poet: now let us patiently hear out his imitator:—

'Listen to the wedding bells,
To the music of the wedding bells,
To the merry, merry wedding bells,
To the joyous, gladsome wedding bells!
They are singing of the might,
Born of unity and love,
Born of sacred wedded love,
And the harmony of love,
And the victory of love.
O those love-inspiring wedding bells!
Every sweet vibration tells
Of the great Creator's mystery; it rises and it swells,
Imploring Benediction, through the sacred wedding bells!'

In conclusion, we might have been more indulgent, even unto a friendly silence, if this booklet of 124 pages had been the author's first work; but when we find it forced upon us that she has published six others, presumably no better than Job's Temptation, we feel that in the interests of educational literature we cannot leave such so-called poetry to pass muster uncondemned.

Farnsworth's Domino Cards. Manchester: J. B. Ledsham.

Arithmetic is the 'common logic' of the people, and, as one of the 'three R's,' is enforced in the public elementary schools of this country. The method by which this subject is taught must largely determine its value as an instrument of education, and on the early processes of instruction will depend generally all subsequent development. Unlike some other subjects, arithmetic to be really useful demands a clear conception and a definite understanding of each step before another can be advantageously taken. Hence the 'first four rules.' But this is a misinterpretation, if subtraction is made to follow addition, and multiplication is then made to precede division. A common mistake has been to take these 'rules' in the order indicated, and even to require the addition of long columns of figures including 'millions' before proceeding to subtraction. This practice is now discarded by all intelligent teachers of young children, and an appeal to their observation—to their 'intuition'—by the presentation of *objects* has happily been substituted. The abacus or ball-frame was long the only 'apparatus' found in our infant schools adapted to this purpose, although, of course, ingenious teachers used laths, pebbles, and other appliances to aid in the correct conception of any given number. Other devices have been recently supplied, each affording some valuable suggestion. The most recent is the special adaptation of the arrangement of the domino 'dots' to the purposes of instruction in number. Farnsworth's Domino Cards give, on a large scale, the familiar double arrangement of numbers up to *nine*. The groups of dots, always presented in the same order, are themselves the unvarying symbols, and need no immediate translation into 'Arabic numerals.' This great advantage of *ready* representation 'in the concrete' of all numbers less than ten in every possible combination gives to these fifty-four cards an unspeakable value. Children can learn to add, subtract, multiply and divide with exactness and rapidity, 'up to eighteen,' by the use of *single* cards; and two or more cards can be employed as effectively for more advanced exercises. On the basis of a knowledge of number thus firmly laid may be erected an enduring superstructure. Our opinion is confirmed by the testimony of H.M. Inspector, John Lomax, Esq., M.A., who records, with satisfaction, that 'remarkable accuracy and quickness in the teaching of numbers has been secured' in the Infant School at Stockport, where these Cards have been introduced. We confidently commend these Domino Cards.

An Elementary Text-book of Botany. Translated from the German of Dr. K. Prantl. The Translation revised by S. H. Vines, M.A., D.Sc., F.L.S. W. Swan Sonnenschein and, Co., Paternoster Row.

It is a question whether the library of the scientific Englishman is not becoming a little over-burdened with translations from the German. All the world knows that the Germans are *facile principes* in that immense faculty of taking pains that is one great requisite of genius of a natural science order. Their patient investigations during the last few years in Physiology, Zoology, and Botany have revealed more actual facts as to plants and animals than have been furnished in the same time by any other nation. We owe them a heavy debt of gratitude for the vast store of materials they have accumulated. But we are not sure that in their admiration of German industry the English scientific folk are not becoming a little slavish. An idea seems to have arisen that translations from the German are the only reliable scientific books, and that any work of purely English origin would not be sufficient for the study of a given subject. And as far as Botany is concerned the leaders in the scientific world seem to encourage this notion. Not one of our foremost English botanists has brought out an original work of any magnitude on the subject during the last twenty years. Professors Thiselton Dyer, and Bennet translate Sachs, Lehrbuch in place of giving us a work from their own pens, and Mr. Bennet further translates Otto Thomé's book.

Dr. Vines, in his turn, translates Prantl's work. Professor Bentley's book, in its later editions, deviates but little from the first edition, that was published in 18—. Truly Dr. Maxwell Masters, in his excellent re-editing of 'Henfrey,' gives us all the latest facts and theories. But these are still arranged on the basis of the work of 1857.

The English Botany book is yet to be produced. Before long probably some English scientific man will give us a work in which all the many facts collected by the indefatigable patience of foreign observers and their generalizations will be collected and arranged, in that systematic and tangible manner which would seem to be the special prerogative of our English writers.

In the main the book before us would serve very well for the student who has studied plants practically, and who is not yet sufficiently skilled to comprehend the large work of Sachs. This volume should be taken as the intermediate stage between that practical dissection and description of plants that must be the first step in Botany, and the reading of the highest treatises. Dr. Prantl deals, after the fashion of modern botanists, largely with the Cryptogamia. The fashion is an excellent one, for larger, more interesting, and more important generalizations are probably to be arrived at by the study of low plants than by the study of the more complex forms. The whole question of the evolution of plants, and of the gradual separation of vegetable living things from animal living things in the course of development, turns on the knowledge of these low forms of plant life. Hence the modern teacher of Botany who does his work well early leads his students to study the Cryptogamia. He will find in this volume a very excellent account of that sub-kingdom, and in addition some useful practical hints as to the locale and the habitat of the commoner forms of these flowerless plants. Some of these hints, we take it, are from the pen of Dr. Vines, as they have in many cases an English rather than a German significance. With advancing botanical knowledge comes the necessity for the modification of those purely artificial arrangements that we make of plants and animals to aid us in our remembrance of their structure, their functions, and their relations one to another. Our systems of classification need reconstructing, and in this constantly recurring reconstruction we are sometimes likely to forget the immensely important fact that all systems of classification are artificial, and that in Nature there is no such thing as a class, or an order, or a genus. So long, however, as we bear in mind that divisions and subdivisions are of man's making, and are only convenient ways of tabulating, and aids to remembering facts, classification will be of use to us. The system adopted by Professor Prantl differs largely from that hitherto in vogue in England.

The classification of the Cryptogamia is a thoughtful and reasonable one. We regret, however, that one piece of nomenclature introduced by Messrs. Bennet and Murray at the meeting of the British Association in 188— has not been incorporated here. That is the careful distinction between the use of the ending 'spore' and the ending 'sperm.'

We should take exception further to the placing of Characeæ as a division of the Algæ. There is in this division of plants a marked distinction between axis and appendages that is not presented by any other of the

plants classed under the head of Algæ. If morphological distinctions are of any value in classification, surely so striking a one as this ought to serve to separate Chara and Nitella from all the plants in which there is no distinction between a central stem and the lateral appendages as the branches, leaves, and sexual organs, that are borne by that stem.

Turning to the classification of the Phænogamia, that are an admirable modification which separate the Gymnospermeæ from the Angiospermeæ *before* making division into Monocotyledones and Dicotyledones. The further subdivision of these two last classes on pages 206—229 presents many points of difference from the system at present used by English botanists, and we are not sure that in all cases the alteration is for the better.

Dr. Vines has given a very useful appendix, by the aid of which the relative positions of the English orders and the divisions of Dr. Prantl can be seen at a glance.

The account of the structure and functions of plants is excellent, though the hypercritical will take exception to the terms used in the titles of the first and second parts. Anatomy, we still think, should be a general name for the whole body of facts that bear upon structure. Its subdivisions are Morphology, the name for facts in relation to organs, and Histology, the name for the facts in relation to tissues. The book under consideration, unfortunately, speaks of the Histology of plants under the name of Anatomy.

We are inclined also to join issue with our authors in their retention of the ugly phrase, 'alternation of generations.' It is so misleading a phrase that we would suggest the use of H. Spencer's 'hetero-genesis' by all biologists, in place of the older and less accurate name.

The student who has carefully studied, by dissection and microscopic investigation, actual plants, and who desires to pursue his botanical studies in company with the best authorities by the aid of the most advanced works, will find Dr. Prantl's book of use as an intermediate stage, at least until our English botanists produce a text-book that is not a translation from a foreign author.

Standards of Teaching of Foreign Codes relating to Elementary Education. By A. Sonnenschein. London: W. Swan Sonnenschein and Allen.

'Nothing can be more serviceable to the cause of national education than that the English people should be accurately informed as to what our neighbours and competitors are doing.' Thus wrote Mr. Mundella on June 14th, 1881, on receiving proof-sheets of this useful publication. We fear that, with regard to educationists generally, it was published too late to serve its immediate purpose, which had reference to the 'Proposals for the Amendment of the Code,' which were generously submitted to public criticism. But an accurate compilation of this nature, exhibiting the standards of attainments required for school children of a given age in the chief States of Europe can only lose its value by the lapse of time. Fifteen countries are selected, and their regulations as to arithmetic, language, geography, etc., are minutely given. Though these Standards are by no means uniform, there is evidence in almost every case of their having been determined by practical men. An Introduction of fifteen pages contains some sensible strictures on certain points in our English Code, and we endorse nearly all that the author has written on the subject of "Intuition"—the German 'Anschauung,' or 'Teaching by Observation.' We believe, with Mr. Felkin (quoted p. 17) that 'it is the most important of all kinds of instruction,' inasmuch as in the hands of a good teacher 'it forms the child's mind, and develops his powers of observation.' The 'oral lessons,' formerly so prevalent in our public elementary schools, have been almost crowded out by the mechanical drudgery of the 'three R's.' There is, however, some hope of a return to intelligent methods, especially in the work of our infant schools. We are glad to commend to the attention of all patriotic educationists what Mr. Mundella calls an admirable and valuable work. Mr. Sonnenschein apologises for its incompleteness, but so far as it goes we believe it to be reliable.

A History of Modern Europe, for Schools. By John Lord, LL.D. London: Simpkin and Marshall.

Dr. Lord's 'History of Europe' has been a school book for about forty years, and its sale has reached forty-seven thousand. This success renders lengthened notice on our part superfluous. Our duty is to intimate the addition of four supplementary chapters, bringing the book nearly to the present date; together with an appendix of questions for examination on each chapter. These supplementary chapters are not unworthy of the book, being written so as to comprise the principal of recent events, and with general fairness in regard to party politics. The questions are less able, being in many particulars too literal and commonplace. A better suggestive question on the miseries of the French retreat from Moscow might have been adopted than 'How many horses died in a week, and what was done with their remains?' Generally speaking, an answer to a question should be found in the text. We look in vain through the paragraph which describes the Great Exhibition (p. 426) for information to answer the question 'What made this (the Exhibition) a great success?' All we can gather from the descriptive paragraph on this point is, 'It was a great success,' without any hint as to the causes thereof. The author of these supplementary chapters has also mistaken the famous expression in Louis Napoleon's letter to the Empress, in which Prince Imperial is spoken of as having received his 'baptism of blood,' and this is referred to by the question, 'What was the "baptism by fire?"' We turn to the text—rather puzzling to find under the general date, 1848 to 1880—and find the phrase 'baptism of fire' spoken of as having been used in regard to the trifling affair at Saarbrück, the only gleam of success that shone on the French forces. Questions like the following also occur:—'What is the present condition of the Republic?' (of France). Rather a difficult one, we submit, to be answered by a schoolboy student. 'What are the great sources of national wealth?' we regard also as much too comprehensive. 'How has Prussia astonished the world?' might be answered in several ways; but 'What about Bismarck?' would puzzle many a politician to answer, and the following question, 'What is his policy?' drive the poor examinee to despair. The author—we still speak of these supplementary chapters—also calls (p. 461) the German Reichstag by the term Reistadt, and spells Gortschikoff with a z—Gortszikoff—both, we fancy, unusual. The author also attributes the rapid recovery of France from the disastrous effects of the German war mainly to the extensive division of the soil among small proprietors. This is very questionable. The recuperative power of France was more plainly attributable to the habits of thrift and prudence on part of the masses of the people, together with their hoarding up savings, in addition to ordinary investments, against a rainy day. The appearance of these savings in buying shares in the Rentes astonished even the great French financiers, and enabled the nation to pay off the immense German indemnity at a very early period, and without any interruption to national industry. The paper and printing of this edition are inferior to the editions issued in Dr. Lord's time. With better examination questions, and the convenience of giving the precise date to each paragraph, this book will hold its own as one of the most useful of modern histories.

Elementary Science Manuals. Botany for Schools and Science Classes. By W. J. Browne, M.A. Lond., Inspector of National Schools. Dublin: Sullivan Brothers. London: Simpkin, Mashall and Co. 1881.

This would be a very useful book to any one who had read a great many others. An advanced student in Botany

would find it of value in placing in very condensed and not altogether unsystematic form a large number of more or less valuable facts. But we cannot think that these books, that always remind us of Liebig's extract of meat, are of use in themselves to beginners. Without much, very much explanation, Mr. Browne's book must be wholly unintelligible to young students. Its most possible use would be as a text-book in the hands of a good teacher, who might well model the course and details of his lessons on the method here adopted.

To get rid of the fault-finding. Is it not to-day a pity in any scientific book, no matter how simple, to use the Fahrenheit scale in preference to the Centigrade? This is done in the volume under discussion (page 14, line 19 from end). The old-fashioned word 'pistil' is retained instead of the more accurate 'gynœcium.' Mr. Browne would probably be the first to admit that this pistil is an exploded one. Cryptograms, again, are not so called because 'their floral organs are hidden' (p. 17). The name is given to them because their sexual organs are minute and difficult of discovery. And lime is not calcium oxalate, though the student of page 20 would be led to this inference. The more recent and more meaningful terms dorsifixed and basifixed are, we think, better in relation to anthers than adnate and innate (p. 51). And the descriptions of certain plants given at the end of this little volume are far too meagre to be of much use, whilst to give a little pageful of 'useful products,' 16 all told, is doing either too little or too much.

The book is accurate on the whole, and is evidently written by a man acquainted with the subject. The author has read Sachs. The diagrams are of the good old type. A number of questions are given on the subject-matter of each chapter. But these kinds of questions are on the whole, we fear, useless. Students will not use them, and teachers ought to construct them for themselves.

Light, Heat, and Sound. By Annie Besant. London: 28, Stonecutter Street, E.C.

This treatise is clear, free from verbosity, and contains a judicious combination of reference to familiar phenomena, scientific explanation and demonstration by arithmetical or other formulæ. To most of the chapters useful examination questions are appended, by which the utility of the book will be greatly increased. We should prefer the illustrative diagrams to be printed with the text, whereby the trouble of turning back to two Photo-lithographed sheets would be avoided. The student will find modern scientific theories sufficiently alluded to in this manual without being unwisely discussed. As an illustration of this, we may quote the opening sentences on HEAT. 'Heat, like light, is a mode of motion, and heat and light cannot wholly be separated.' This is followed by experimental proofs of the statement, and is enough for the student who is not desirous of fully examining the proofs of the Correlation of Forces, nor the resolvability of a group of sciences into the results of Motion. Speaking of the fact of water boiling by less heat under less atmospheric pressure—about one degree for every 300 metres—'On high mountains, therefore, cooling becomes a matter of difficulty, as the water passes into steam before it is hot enough to cook meat.' In several passages the authoress honestly refers to the leading authorities—Deschanel on Heat, and Tyndall on Sound,—a praiseworthy habit in all scientific manuals.

An Easy System of Calisthenics and Drilling. By Thomas McCarthy. London: Allen and Co.

Physical exercises are now pretty well established in modern education. Their importance is felt in regard to healthy muscular development, which in regard to girls was too often confined to a formal walk and occasional lesson with the wand and rings. What a well-devised system of drill effects is shown by the conversion of the awkward and half-bent country lout into the smart soldier with his elastic yet firm step and erect bearing. To simplify the course of regimental drill, seems to be a desideratum for boys and girls' schools, and this the book before us carries out. Adequate directions are given in regard to the manner of performing the various movements, together with cautions against faults to be avoided. The drill and marching exercises are supplemented by those with the wand, light dumb-bells, and Indian club. The descriptions, of whose clearness we cannot complain, would be immensely improved by the addition of diagrams or descriptive figures.

A Practical Introduction to Greek Prose Composition. By Thomas Kerchever Arnold, M.A. New edition, edited and revised by Evelyn Abbott, M.A., LL D London: Rivingtons.

Two such sponsors for a book as Messrs. Arnold and Abbott must assure the world that their brain-child is everyway commendable. There cannot possibly be a better help to the young Grecian than this easy and exhaustive manual. In a day scarcely yet gone by, Greek grammars were the torment and abhorrence of schoolboys, dog Latin being the medium for explaining those more hieroglyphical secrets of the crabbed Greek, and to thousands beside the present writer, aorists, supines, and verbs in μι were in those years, ay, and still are, baffling and inscrutable mysteries. Now, however, by means of such an introduction as this, with its lucid order and its popular and easy explanations in our familiar Queen's English, the road to Parnassus is strewed rather with flowers than with flints, and all diligent scholars may go on their way rejoicing. Those terrible old grammars of Eton, Winton, and good King Edward may well be voted obsolete, while such pleasant substitutes as the book here noticed, usurp with all acceptance their ancient places in these fortunate modern times.

Lessons on Form. By Richard P. Wright. London: Longmans, Green and Co.

All geometricians are aware that the title of this book indicates a series of steps in the field that Euclid has developed into the grandest system of mental training yet known. But the term *form* would not be thus understood by a novice. To beginners, however, in the mathematics of form, such explanatory lessons as Mr. Wright here gives will be most valuable accompaniments to the study of Euclid, side by side with which it should be read. Taken by itself, Mr. Wright's book gives the substance or marrow of many of the results which Euclid develops by a regular series of steps that hang together and support one another like links of a chain. Such a rigid logical course Mr. Wright does not attempt, but his lessons are none the less valuable, and will greatly assist the student in rightly appreciating the nature of the geometrical field. As an example of the thoroughness of Mr. Wright's explanations, we may mention the lesson on ANGLES, with the number and character of each according to the points of intersection. A thorough knowledge of this chapter will form an excellent preparation to the study of triangles, with which Euclid begins. Mr. Wright's lesson (Chapter IV.) on TRIANGLES may be read beside the First Book of Euclid with great advantage, as showing the principal results aimed at, together with various ways of proving several propositions. The importance of Euclid's famous 47th Proposition (Book I.), generally known as the Theorem of Pythagoras, and on which a great deal of Mensuration and the whole superstructure of Trigonometry rests, will be well understood by Mr. Wright's clear and explanatory chapter, the 7th in his book, in which he lucidly shows the leading algebraical formulæ thence derived, together with the *rationale* for the main processes of Mensuration. Several methods of demonstrating the great theorem are given in addition to that by Euclid. The student will find himself in safe hands in mastering Mr. Wright's pages.

Civil Service History of England. By A. White and H. A. Dobson. London: Crosby, Lockwood and Co.

This is not improperly called a fact-book of history, as indeed crammed with a marvellous number of facts. The first half of the book comprises a summary of the usual historical details. The second half is made up of a series of appendices or special chapters on Constitutional History, Colonial and Indian History, British Biography, Literature, and Inventions and Discoveries. There may be some advantages in treating these latter-mentioned matters separately. We refrain from discussing the general value of these compendiums as short cuts to preparations for examinations. How far even memory is made certain by a firm impression being made by a complete picture instead of by a bare outline will depend very much upon the nature of the examination, as to whether a reasoning or deductive set of questions are set or those merely requiring the recapitulation of facts and dates. For the latter 'cramming' may be sufficient, but history is no more represented thereby than is a human being by a skeleton. The evils, however, belong more to the system than to this book, which is well enough of its class. Scarcely a word is uttered in common with the majority of made-up books on British history. The authors, instead of discarding, keep to the misleading term *Anglo-Saxon*. The authors sum up Stephen's character as 'warlike and cruel.' This phrase is not only badly written, but scarcely accurate. Stephen was more weak and yielding than cruel. He was indeed mild for the age, and his great fault seems to have been that of irresolution. Beckett is mentioned as 'Archdeacon of Canterbury,' which we are willing to regard as a slip for Archbishop. The author falls into the popular, erroneous expression, Joan of Arc, instead of Jeanne Darc. There is no place named Arc near Domremy, Jeanne's birthplace. The necessity for compression leads to a rather vague description of the National Debt. The second part of the book is more satisfactory. The constitutional part is thoroughly well done.

As India and the Colonies are treated each to an appendix we think such a Supplement is necessary to Ireland, and also to Scotland.

Engagements for March.

March 2.	Royal Society	4.30 p.m.
	Linnean Society	8 p.m.
,, 3.	Press Committee N.U.E.T.	
,, 4.	Leicester School Association Meeting	
	Bristol School Association Meeting	
,, 8.	Anthropological Society.	8 p.m.
	Geological Society	8 p.m.
,, 9.	Metrop. Board Teachers' Association. Committee Meeting	
	Royal Society	4.30 p.m.
,, 10.	Derbyshire District Union. Annual Meeting	
,, 13.	Royal Geographical Society	8.30 p.m.
,, 15.	Parliamentary and Law Comm. N.U.E.T.	
,, 16.	Royal Society	4.30 p.m.
	Linnean Society	8 p.m.
,, 17.	Executive N.U.E.T.	
	New Shakspere Society	8 p.m.
,, 18.	West Lancashire and Westmoreland District Union. Annual Meeting	
,, 22.	Geological Society	8 p.m.
	Anthropological Society	8 p.m.
,, 23.	Royal Society	4.30 p.m.
,, 24.	Browning Society. Rev. J. Kirkman, M.A.	8 p.m.
,, 27.	Royal Geographical Society	8.30 p.m.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR.'

(1) 15. (2) 30. (3) 3. (4) 5. (5) -12. (6) 24. (7) 78. (8) 13. (9) 2400. (10) -120. (11) $16\frac{1}{2}$. (12) $\frac{1}{15}$. (13) 24. (14) 8. (15) 84. (16) $\frac{5}{16}$. (17) $48\frac{1}{2}$. (18) -10. (19) $a+b$, $a-b$, ab, and $\frac{a}{b}$. (20) $240x$ pence. (21) $\frac{x}{y}$ £ each. (22) $\frac{x}{2}$, $2x$, $x-y$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR.'

STANDARD III.

A. 1. 189—7.
2. 202—11.
3. 2174—7.

B. 1. 2414—10.
2. 14,948—28.
3. 37,091—36.

C. 1. 8389—28.
2. £931 5s. 4½d.
3. £4374 3s. 10d.

D. 1. £642—15s.
2. 8479—430.
3. 248—1664.

E. 1. £1153 6s. 10½d.
2. £8516 17s. 10½d.
3. 1,030,554.

F. 1. 3,122,966 f.
2. £223 14s.
3. 21,734—843.

ADVANCED EXAMINATION.

1. £596,431 0s. 3½d.
2. 1s. 1d.
3. £168 15s.

STANDARD IV.

A. 1. £879 16s. 1½d.
2. £44076 18s. 7½d.
3. £510 17s. 3½d.—6.

B. 1. £598,228 16s. 9d.
2. £289,115 12s. 6d.
3. 188,160 oz.

C. 1. 209 tons 5 cwt. 1 qr. 2 lb.
2. 588,060 sq. ft.
3. £1 2s. 6d.

D. 1. £425,766 19s. 7½d.
2. 12s. 0⅘d.
3. £428 19s. 0½d.—102

E. 1. 714 days 14 hrs. 25 mins 39 secs.
2. 486,600 secs.
3. £11 11s. 3½d.—2,694.

F. 1. 87 tons 4 cwt. 0 qrs. 12 lbs. 3 ozs. 2 drs.
2. 200,750 bricks.
3. 569,204 yds. 0 qr. 2 nls. 1½ ins.

ADVANCED EXAMINATION.

1. £16 17s. 6d. gain.
2. 4½ hours.
3. £487 10s.

STANDARD V.

A. 1. £8 10s. 0½d.
2. £22 8s. 0⅘d.
3. £478 10s. 1½d.

B. 1. £166 2s. 1d.
2. £112 1s. 3d.
3. £1374 16s. 1½d.

C. 1. £8635 6s. 3d.
2. £16711 5s. 0½d.
3. £33779 12s. 8d.

D. 1. £87 0s. 9d.
2. £8 7s. 5½d.
3. £331 8s. 6½d.

E. 1. £52 10s. 0½d.
2. £80 17s. 2½d.
3. £4 16s. 4⅘d.

F. 1. 31½.
2. 3⅘ days.
3. £1 17s. 4½d.

ADVANCED EXAMINATION.

1. £14,373 8s. 9d.
2. £3 10s., £7, £10 10s. and £21.
3. £149 0s. 1⅘d.

STANDARD VI.

A. 1. $2\frac{13}{14}$.
2. $1\frac{1}{14}$.
3. $\frac{84}{175}$.

B. 1. 71·9075.
2. 76·7.
3. ·159375.

C. 1. 200 shirts.
2. 20 days.
3. 189 ton.

D. 1. $25\frac{91}{180}$.
2. £28,586 13s. 4d.
3. $5\frac{73}{112}$.

E. 1. £32 1s. 9d.
2. £268 2s. $6\frac{1}{16}$d.
3. 74·503606.

F. 1. $3\frac{1}{140}$.
2. $\frac{81}{1000}$.
3. £23 2s. 10½d.

ADVANCED EXAMINATION.

1. $2\frac{11}{180}$.
2. 7s.—0·19572d.
3. 14,000 lbs.

STANDARD VII.

A. 1. 234.
2. £201 6s. $5\frac{1}{10}$d.
3. £365 5s. $7\frac{17}{100}$d.

B. 1. 11 years.
2. 4078.
3. 3 per cent.

C. 1. £1 18s. $4\frac{833}{1825}$d.
2. £357 2s. 10½d.
3. 23.

D. 1. $33\frac{1}{3}$, 25, 20 years.
2. $17\frac{137}{180}$ days.
3. £1600.

E. 1. ·0000171875
2. £2075 18s. $9\frac{1}{16}$d.
3. $4\frac{1}{2}$ per cent.

F. 1. £548 16s. 10⅜d.
2. £180.
3. 1,514,002 min.

ADVANCED EXAMINATION.

1. £2281 15s. 11⅛d.
2. £3 8s. $4\frac{88}{89}$d.
3. 466·689, 155·563 yards.

COME, GENTLE SPRING.

Words by JAMES THOMSON. *Music by* T. CRAMP.

Andantino. mf

1st TREBLES.
2nd TREBLES.
BASS.

1. Come, gen-tle spring, with all thy train, Un-loose cold win-ter's i-cy chain;
2. Come with your gen-tle vo-cal throng, That fill our woods with joy-ous song;
3. We long to hear the cuc-koo's cry, The soar-ing lark sing in the sky,

KEY G. *Andante. mf*

1st TREBLE.
2nd TREBLE.
BASS.

And with thy life-re-vi-ving breath Wake Na-ture from the sleep of death.
Wa-ken a-gain the dor-mant bee, And clothe a-new the leaf-less tree:
Up-ri-sing high on tire-less wing, To wel-come back the joy-ous spring.

D. t.

Come, bring us sun-shine and fresh-'ning showers, Stir-ring to life the
Come, clothe the mea-dows, now bleak and bare, With grass-es green and
Come with the prim-rose and fra-grant flowers, To deck a-gain our

f. G. *mf.*

legato.

sleep-ing flowers! And to our hearts new plea-sure bring, With all the
dai-sies fair; The na-ked hedge-rows, brown and sere, Ar-ray in
wood-land bowers; And then a song of praise we'll sing, With grate-ful

legato.

joys of beau-teous spring!
green-'ry bright and clear.
hearts to thee, O spring.

Symph.

Symph. p

We beg to announce that any of the songs which have appeared in the back numbers of the PRACTICAL TEACHER may now be obtained separately, price 6d. per dozen, post free.

The Practical Teacher.

A MONTHLY EDUCATIONAL JOURNAL.

To Subscribers.—The *Practical Teacher* is published on the 25th of every month. Price 6d.; post free, 7½d.; sent post free, three months for 1s. 11d.; six months, 3s. 9d.; a year, 7s. 6d.

P. O. Orders should be made payable at Chief Office.

Subscribers not receiving their copies regularly are respectfully requested to write to the Publisher.

It would save time and expense if subscribers when remitting would state exactly what numbers they wish to be sent.

To Correspondents.—All literary communications should be addressed, THE EDITOR OF THE PRACTICAL TEACHER, Pilgrim Street, Ludgate Hill, London, E.C.

Accepted contributions are paid for within twenty-one days of publication.

The Editor cannot return rejected MSS.; authors should therefore retain copies.

TO ADVERTISERS.

Approved, *prepaid*, advertisements will be inserted in the *Practical Teacher* at the following rates:—

	s.	d.
20 words or under	3	0
Above 20 words and under 32 words ...	4	0
32 words and under 64 words	5	0
For every additional 10 words	1	0

Teachers Advertising for Situations.

	s.	d.
20 words or under	1	0
For every additional 10 words	0	6

For an ordinary page	4 guineas
For page facing matter	5 guineas.
For 2nd page of wrapper	5 guineas.
For 3rd page of wrapper	5 guineas.
For the page opposite the 3rd page of wrapper	5 guineas.
For the 4th (back) page of wrapper ...	6 guineas.

Parts of a page are charged at a slightly higher rate.—Special quotations will be given for a series.

☞ **Portfolios, fitted with elastic bands, for preserving twelve numbers of 'The Practical Teacher,' may now be had. Price 2s. 6d., post free.**

Nos. I. and II. of The *Practical Teacher* are now out of print.

Monthly Notes.

THE ARCHBISHOP OF YORK ON INDUSTRIAL SCHOOLS AND REFORMATORIES.—The new building of the York Certified Industrial Boys' School was opened by His Grace the Archbishop of York, president of the institution, on the 31st January. After the singing of a hymn, and prayer by the Rev. F. Lawrence, the chaplain, His Grace said that they were met that day on a very important business, to open three rooms in connection with the York Industrial School—the room in which they then were, and two others. It seemed to the committee that at present there was cause to be anxious about the future of industrial schools; and if they would pardon him for a minute, he would state what the causes of anxiety were. An industrial school, such as that, was a school for the waifs and strays of the population—those boys who were growing up in neglect, and with every prospect of ruin before them unless a helping hand was stretched out to them. But there were boys who had not yet come within the reach of the law for any criminal offence. A reformatory was quite a different thing. The child who had got for the first time into the hands of the magistrates, instead of being sent to a prison and so branded as a gaol-bird, was taken aside from the associations that surrounded him, and was shut up for a definite period in a reformatory school, in which he learnt some useful trade, and became, under proper management, a useful and excellent member of society. There was always expressed a warm wish and a constant intention to keep the industrial school apart from the reformatory, and for this very obvious reason. He could imagine nothing more cruel, more unjust, than to associate a boy whose only guilt was the misfortune of being poor, and being obliged to run about in the streets for want of a home to resort to, with those who had actually committed some crime. In the words of Sir Stafford Northcote in 1857, the matter was very well expressed:—'These children demand care and attention, not merely from motives of humanity, but from reasons of state policy connected with our criminal legislation; the difficulty of dealing with our criminals would be materially diminished if we could cut off the supply of those criminals at its source. These children not having committed crime, it would be unjust to associate them with those who had.' There the whole question lay in a nutshell. His Grace then referred to the state of poor children in the London districts, and said that their condition was too painful to think of. But there was one comfort—an institution like that. Why evil was allowed in the world, no one would ever tell; but one reason of its being allowed they might easily learn. Let them try to deal with it, try to do something to help it, then they would understand that it was to them a good—an incentive to noble exertions; and they felt they were doing a service to their great Master, Christ, because they were doing to His little ones what He would have done to them.

BEDFORD ASSOCIATION OF ELEMENTARY TEACHERS.—A meeting of the association in and around Bedford was held on Saturday, January 28th, in St. Mary's Schools, Bedford, under the presidency of Mr. Hall, of Ravenstone. There was a good attendance, the subject for discussion being the representation on the executive of schools in agricultural districts. On the motion of Mr. James, seconded by Mr. Hammond, it was unanimously resolved, 'That, in the opinion of this meeting, it is desirable that country districts should be more adequately represented on the executive, and that steps be now taken to secure that object.' Mr. Powell, of Northill, was then nominated, and a resolution passed pledging the associations there represented

to do all they can to secure his election on purely agricultural grounds. As a means of securing the co-operation of teachers throughout the country, it was decided to send letters to the educational papers, pointing out the great need of an agricultural representative, and asking the associations to support Mr. Powell with their votes at the conference to be held at Sheffield, in Easter.

THE BIRMINGHAM DISTRICT UNION.—The annual meeting of this union was held on the 16th February. The new president, Mr. Clark, after thanking them for the honour conferred on him, said that he would confine his remarks to that part of the proposals which referred to the administration of the grant. This was the supreme consideration both to managers and teachers, and was in so unsatisfactory a condition that he believed their whole efforts would have to be concentrated to put this on a satisfactory basis. He did not blame Mr. Mundella, who had done more than any previous statesman to earn the esteem and confidence of teachers and to prove his interest in the subject, for the monstrous proposition in art. 14 as to 100 per cent. for the maximum grant. Such an outrage on common sense could only have emanated from permanent officials removed from the ordinary experience and sympathies of human life. It betokened the most profound ignorance of the real bearings of this question. The president quoted figures from the *Times* to show that by the operation of the six months' clause 500,000 more children would be examined, and that this would probably bring down the average percentage to sixty-six. If schools favourably conditioned were taken into account, the great majority would therefore have hard work to earn a half of the maximum grant on the average attendance. And this was on the present high-pressure system, which teachers had fondly hoped was to be brought to an end, or at least modified. He argued strongly for the seventy-five per cent. demand which he believed under the proposals would be difficult to get, and which he thought would show very high results in the great majority of schools. Art. 14 would inflict great injustice not only on managers and boards, who were able to take care of themselves, but on teachers of schools in certain conditions. Forty per cent. might be better in some than ninety in others. The special merit grant could not possibly adjust the difference of grant in such cases, or if it could it would be a most powerful and dangerous weapon in the hands of any man, whether inspector, minister, or practical teacher. This article (14) he felt sure would prove a burden too heavy to be borne, and he believed that if teachers were unanimous and in earnest, their demands would be joyfully conceded before long, not only to their own satisfaction, but to the best interests of the children and the nation, and to the complete satisfaction of the department itself.

HACKNEY DISTRICT ASSOCIATION OF TEACHERS.—The annual Soirée of this flourishing Association took place on January 27th. Mr. Day—we beg his pardon, Captain Day—the President, did the honours of the evening. After light refreshment, dancing began about half-past eight, and was kept up till the small hours of the morning, to the lively strains of an efficient band. The evening's pleasure was also enhanced by the musical efforts of Miss Annie With, Mr. Needham, and Mr. T. Gardner. The last-named gentleman acted, with his usual courtesy, as M.C. Among the visitors we noticed Messieurs and Mesdames Heller, Devnish, Day, Tomlinson, Jeffries, Waugh, Gardiner, Filer, and Powel.

Gossip.

With this number we begin our second volume, and avail ourselves of this fitting opportunity of rendering our warmest thanks to the many friends all over the world who have interested themselves in the fortunes of our Journal. Its success, which dates from the first number, has, we are grateful to say, been permanent.

***

As it is our aim to make our magazine indispensable to every teacher, we are always glad to have suggestions from our readers. Some, however, must, we fear, be disappointed at our non-compliance with their requests. To such, we can only say, that our space is limited, and that if we had attempted to carry out half the 'special features' kindly sent us by correspondents we should have had to quadruple our pages. In making a selection, we try to choose those subjects of interest to the grestest number of our readers. We are sincerely sorry that we have not been able to print more artieles bearing directly on the schoolmistresses' work. The requests have been so many, and still continue so urgent for these articles, that we have decided to issue on the 23rd of March a new ladies' educational monthly. No effort shall be spared to make it worthy the support of our fair friends. We need only further state here, that several of the first living educationalists, both men and women, have been engaged, and are now writing for the magazine, particulars of which will be duly announced in the educational weeklies.

***

Perhaps we may be pardoned for drawing attention to the little journal, *The Scholar*, which we present with our current issue. It is hoped, to use the old hackneyed phrase, that it will meet 'a long-felt want.' Teachers who adopt it in their schools, may rely that the contents will always be kept abreast of the Code.

***

Speaking of the Code and its requirements, reminds us that a few minutes ago we received a card of invitation to 'A Conference of Educational Publishers.' The subject for consideration may interest a large section of our Metropolitan teachers. It is 'the Requisition List of the London School Board.' The mere fact of the leading educational publishers of London meeting together to discuss such a subject, is evidence enough that there is something radically wrong in the framing of the above list.

***

It has always seemed to us little short of an insult to the London teachers that they are not permitted to use what books they deem most suitable for their scholars.

***

Further than this, it is no disrespect to the members of the School Management Committee to say that, with one exception—that of Mr. Heller, himself

till lately an elementary teacher—they are *not qualified* to make a selection of books for use in *elementary* schools.

***

The easiest solution of this question, which is as annoying to the worried teacher as to the luckless publisher, is this: The Board has already an account with every respectable publisher, therefore let the teacher be free to select what books he likes, not overstepping the average amount allowed for each child. Supposing, for argument's sake, that a bad selection was made; it needs no wiseacre to see that such a course would work its own cure in a very short time.

***

Then again, what an economy, not only in public money, but in the *time* of the members of the School Management Committee, would be effected. Surely the members, in their own interests and that of the ratepayers, should be willing to discontinue this farce. What would be said if we engaged the distinguished physician who sits at the Board, on the condition that in prescribing for us he should use certain medicines of our own choice! Such a proposition would be preposterous. In no walk of life other than that of the teacher's would it be tolerated.

***

Professor Stokes, of Cambridge, has accepted the appointment of Burnett Lecturer in connection with Aberdeen. He will hold the appointment three years, if he delivers a course of lectures at Aberdeen upon 'recent researches in physical science, with special reference to natural religion.' These are the new regulations of the Burnett trust, and the lectures have been instituted in place of the Burnett Prizes which were awarded every forty years. The prize in 1855 was won by Principal Tulloch, and that of 1815 by Archbishop Sumner.

***

Mr. E. Nicholson, Librarian of the London Institution, has been appointed by the curators to be librarian of the Bodleian, vacant by the death of Mr. Coxe. It is understood that Mr. Nicholson possesses excellent qualifications for the office as respects practical knowledge and experience.

***

We hear that Blackwood's Diaries have this year met with unusual success. The sales have been between one and two hundred thousand, and the public have had the choice of buying them at prices varying from one penny to twelve shillings.

***

Mr. Oscar Wilde, the 'apostle of culture,' and the 'Postlethwaite' of *Punch*, seems to be creating a great sensation across the water. He was not satisfied with his little trip over the Atlantic, and he doesn't seem to think much of Niagara, judging by his note in the memorandum book of the hotel at that place. He says, 'the roar of the waters is like the roar when the mighty wave of democracy beats upon the shore where kings lie crouched at ease.' We never heard the roar of the democratic waves, and we never knew a king who enjoyed easy times. Our own Prince of Wales does as much work as any common labourer, and so do most other sovereigns. Mr. Wilde is evidently growing confused with the incense of adulation showered upon him by the American public.

***

We hear that Mr. Henry Irving has been elected a member of the Athenæum, under a rule which allows the members of that club to select annually some person distinguished in art, science, or literature for honorary membership.

***

A very ancient British kist-vaen has been found in Kent by the Rev. F. Vine, who will shortly publish an account of it in his archæological work entitled 'Cæsar in Kent.'

***

We hear that Mr. H. Sweet has finished his shorter Anglo-Saxon reader, which will be published in the Clarendon Press Series very shortly. The work is intended to form an introduction to a longer work.

***

Mr. J. A. Symonds is engaged in printing a collection of one hundred and fifty original sonnets. Five of these only have been before published, three in Mr. Hall Caine's recent collection of sonnets, and two in *Cornhill*. The volume will be entitled *Vagabunduli Libellus*.

***

Messrs. Hurst and Blackett announce a new work by the author of *John Halifax*, entitled *Plain Speaking*.

***

Messrs. Sotheby's recent sale of autographs included some important documents in the handwriting of Garrick, John Locke, Burns, Nelson, Edgar A. Poe, and a volume of comedy memoranda by Sheridan. There are also rough draughts in Moore's handwriting of *Lalla Rookh*, the *Life of Byron*, the *Epicurean*, and two of the same writer's commonplace books.

SCHOOL DESK FOR ARMY SCHOOLS AND MISSION ROOMS.—A new school desk, of novel and ingenious construction, combining strength, simplicity of movement, and suitability for both children and adults, has been constructed by Mr. Thomas Laurie, 31, Paternoster Row. After being carefully examined and tested by every department of the War Office, it has been formally sanctioned and adopted by Her Majesty's Government for use in Army schools and mission rooms.

We regret to state that an unfortunate error was made in the wording of Mr. G. E. Hawes' advertisement which appeared in our last issue. Mr. Hawes' Desks should have been described, not as the 'Eastern Counties,' the 'Collegiate,' the 'County,' etc., but as the 'Norwich' Desks.

William Chambers, LL.D.

'THE hoary head is a crown of glory, if it be found in the way of righteousness.' So wrote the inspired penman—the wisest of men. We need no better example illustrative of the above sacred truth than the life of William Chambers, whose portrait and autograph we have (through the ready courtesy of some of his Edinburgh friends) the pleasure to present to our readers.

All the world knows that the jubilee year of 'Chambers's Journal' has just been signalized by the appearance of 'Reminiscences of a Long and Busy Life' in that popular periodical. Upon reading this remarkably interesting and profitable *résumé* of a life's work, it occurred to us that as the fortunes of the house of Chambers had been so closely identified with *educational* literature, and that as few indeed must be the schools in which some at least of their many excellent publications are not used, it would be a fit thing to give in our pages a sketch of the early career of the founder of this eminent firm, whose name has long since become a household word.

Yours truly
W Chambers

In so doing we shall, of course, have to draw largely upon the 'Reminiscences' themselves for our information. To few men is it given to write as follows:—

'I think, however, that I am fairly entitled to feel gratified at the singular success of a work which, relying on the support of no party or sect, nor on any species of artistic attraction, should have so long kept its ground, and that now, after a lapse of fifty years, should, judging by circulation, be more popular than it was in the early stages of its career. There is more than this literary and commercial success to be thankful for. It is that the hand which penned the Introductory article in the first number of the Journal in 1832 has been spared to write the present address.'

William Chambers was born in 1800, his oldest distinct recollection being the rejoicings consequent on the triumph of Nelson at the Battle of Trafalgar, October 21st, 1805. Here is the story of his early education:—

'I was not fated to receive more than a plain education in the place of my birth, a small country town in the south of Scotland. Matters there were still somewhat primitive. In the schools I passed through there was not a map, nor a book on geography, or history, or science. The only instruction consisted of the three R's, finishing off with a dose of Latin. I was a simple and cheap arrangement, diversified with boisterous outdoor exercises, and a certain amount of fighting, in which I was forced to take a part. My instruction in Latin came abruptly to a conclusion. Lieutenant Waters, in one of his old novels, says, with more energy than eloquence, that he still bore the marks of "Homo" on his person. I likewise have the honour of bearing similar evidences of my acquaintance with Homo. One day, not being quite prompt in answering a question in Latin grammar, my teacher, in one of his irascible moods (which were always distinguishable by his wearing a short bottle-green coat), lifted a ruler and inflicted a sharp blow on the top of my head, which almost deprived me of consciousness, and which, while leaving a small protuberance, is on occasions, after an interval of seventy years, still felt to

be awkwardly painful. So much for my acquaintance with Homo. With every respect for his agency in mental culture, I shortly afterwards bade the academy good-bye; and so ended my classical education or school education of any kind.'

Lacking as was his school education, we think the doctor was singularly fortunate in that sterner education which comes of having to do battle with life's difficulties. In any business or profession, William Chambers would have made his mark. One has only to look at the firm set mouth, and general contour of the head, for evidence of those qualities which, when used with ordinary discretion, give the Scotchman such vantage in the world's strife. So keen was his thirst for knowledge, that every spare hour was given up to reading, and we are told that he even sold his pet rabbits to buy books.

In May, 1814, he was apprenticed for five years to a bookseller, a strict disciplinarian, who forbade his reading. But the young student was not thus to be easily baulked; he made the acquaintance of a baker of literary tastes, and as early as five in the morning would repair to his bakehouse to read passages from Smollett and Fielding, his reward for this work being,—a hot roll.

As we read the story of these early struggles, we cannot help recalling the somewhat similar experience of Dr. Franklin, and more recently those of Michael Faraday. At this time young Chambers managed to live in lodgings and pay his way on four shillings per week. In recounting this part of his history he says, 'It was a hard but somewhat droll scrimmage with semi-starvation; for as concerns food it was an attempt to live on threepence halfpenny a-day. Yet it was done.'

There is something noble, manly, refreshing, and soul-inspiring in that '*Yet it was done.*'

Is not the bold, self-reliant, and persevering spirit which could dictate such a sentence the true philosopher's stone? To their mother, a woman of singular nerve and resolution, William and Robert, her two sons, owed much. Her advice and example were priceless, 'Aye haud forrit,' was the excellent motto she bade them adopt. At the close of his apprenticeship William had just a crown, and with this sum he began life for himself. To quote his own words: 'I was fortunate in the moment when I was thrown on my own resources. A London bookseller, who had come to conduct a trade-sale in Edinburgh, sought my assistance to arrange his specimens. I willingly lent my aid; and this worthy person, understanding that I wanted to begin business, but only had five shillings of capital, gave me an excellent selection of books on credit to the value of ten pounds. Borrowing a truck for the occasion, I wheeled the books to a small place of business I had secured in Leith Walk, and there I exhibited my stock of books on a stall, which I constructed of wood bought with the five shillings. Again fortune proved favourable. The books were speedily disposed of, and a fresh stock was ordered. A good start had been made. After discharging all my obligations, I had a few pounds over, and by following a rigorous system of thrift, things were decidedly looking up.'

William was bound to get on, as his ready resource never failed him. In wet weather he had plenty spare time. This he turned to good account by copying small pieces of poetry with a crow pen. But better things were in store for him. With an odd three pounds he bought a stock of worn types, cut headlines in wood with his penknife, and thus set up as a printer.

'I actually with these poor appliances began the business of a printer, in addition to my small bookseller's concern. After a little time, overcoming every difficulty, I managed to execute an edition, small size, of the songs of Robert Burns, with my own hands bound the copies in boards with a coloured wrapper, sold the whole off, and cleared eight pounds by the transaction.'

In the autumn of 1821 the two brothers issued a fortnightly, entitled, 'The Kaleidoscope.' This paper had but a brief life, as only eight numbers were published.

For some time after, the elder brother stuck to his printing and bookselling.

Years later, with the establishment of 'The Society for the Diffusion of Useful Knowledge,' 'Schools of Art,' and 'mechanics institutes,' there sprang into existence numbers of cheap periodicals for the people.

'Here,' said I, pondering on the subject, 'is my chance.' He saw the tide rising, and with that decision of character which seems inseparable from all successful men, took it at its flood, and it led him on to fortune.

On February 4th, 1832, the first number of CHAMBERS'S JOURNAL was issued. From the very first it leaped into an immense circulation, and has ever since been growing in favour with that vast constituency for whom it was primarily projected. When the fourteenth number was issued, the younger brother was admitted a partner, and thus was established the firm of W. and R. Chambers. Of the subsequent career of this eminent house it is needless for us to speak. To those, however, who would like to continue the story penned by a loving hand, we say, get the February number of the Journal itself. It will thoroughly well repay a perusal. Honours thick and fast have fallen upon the venerable doctor. And in the name of our twelve thousand readers we congratulate him, and most sincerely wish him light at eventide. 'Seest thou a man diligent in his business? he shall stand before kings.'

JOSEPH HUGHES.

The 'Practical Teacher' Letter Competition.

AWARD OF PRIZE.

(*The Prize has already been paid.*)

JUDGE'S REPORT.

Of the ninety letters received two were reported as disqualified. The writers of remaining eighty-eight not only show a knowledge of the special needs of a young pupil teacher, but, without exception, manifest a kindly sympathy with his position, and encourage him by their own experience as well as by considerations which could not fail to impress his mind with the importance and imperishable character of the work upon which he was about to enter. I cannot avoid stating that the nobility and responsibility of the teacher's vocation is so represented as to stimulate the development of the highest faculties, and from the highest motives. The prize is awarded to 'Hope'; but *proximè accesserunt* 'Uncle George,' 'Daisy Experimento,' and 'St. Botolph,' etc. Nearly one-half of the candidates are ladies, and judging from internal evidence two of the writers just named are

head-mistresses. The high tone of all the letters has made their perusal a positive pleasure.

JOHN R. LANGLER, B.A., F.R.G.S.,
President of the National Union of Elementary Teachers.

The prize (five guineas) in accordance with the above report, is awarded to Hope, (Frederick J. Gould, 1, Minson Road, Victoria Park Road, E.)

Other Competitors.

Nil Desperandum, Asbestos, Minnie, Earnest, An Englishwoman, Mothcol, Effie Howard, Selim, A Scholar in the School of Life, Faith, Experience, Dandelion, Edith, Practical Teacher Minnie, Guppu, Aspirant, Dawson Brooks, A Believer in Education, not in Cram, Der Mutz, Mary Stuart, Tortoise, Uncle George, Snowdrop, N. R. G., Leylam, Daisy Experimento, A. B. H., Keziah, Lesena, Pseudonym I., Lily Nesby, Thistle, Dominie Sampson, Mountain Heather, Marie Rose, Ivythorn, Fort pour Dieu, Charlotte E. Dalton, Sirdar Khan Sing, S. Moore, Peterkin, Pseudonym II., Wild Honeysuckle, Norfolk, L. H., Neophyte, Nil Desperandum II., Index, Teesdale Daisy, Erudio, Marian May, Mayhew Speedwell. Excelsior, Help, Burnside, Excelsior II., Nisi Dominus Frustra, Lælius, Pilot, Willie Winter, Maya, Sir John Long, Zoë, Amicus, Marguerite, Madelaine, Springtime, Silverpen, Wonrad XVIII., Edith Mary Vivian, A Long Fellow, not Longfellow, Rus in Urbe, et in Rure Urbs, Veritas, Electric System, Patricia, Agricola, Mentor; Principiis Obsta, Polonius, A. E. G., Janus, Josephus Tapson, Perseverance, St. Botolph, One who loves Teaching, Labore et Constantia, Violet, and Irene.

Disqualified.

One of the Profession, and Adventura.

—o—

The 'Practical Teacher' Drawing Competition.

AWARD OF PRIZES.

(*The prizes have already been paid.*)

FIRST YEAR—MALES.

The prize, seven shillings and sixpence, has in this division been awarded to

STRONGBOW.

Russell Venables, Rossett National Schools, Wrexham.

Other competitors:—Snowdrop, Rollo, Nil Desperandum, Brutus, Navigator, Venta Belgarum, Nemo, Pupil Teacher, Nitor in Adversum, Alfred.

FIRST YEAR—FEMALES.

The prize, seven shillings and sixpence, has in this division been awarded to

TITANIA.

Rachel Marks, 375, Kingsland Road, London.

Other competitors:—Belper, Effie, E. Room.

SECOND YEAR—MALES.

The prize, ten shillings, has in this division been awarded to

HARRY.

J. H. H. Jarrett, 5, Bridge Street, Bridgnorth.

Other competitors:—Ivanhoe, Welsh Artist, Pop, P. M., Fair Play, Mistletoe, Zeno, Scio, Boy's Own.

SECOND YEAR—FEMALES.

The prize, ten shillings, has in this division been awarded to

CINDERELLA.

Fanny R. King, Great Berkhampstead Board School.

Other competitor:—Violet.

THIRD YEAR—MALES.

The prize, fifteen shillings, has in this division been awarded to

BREDON.

Fredk. H. Lees, 129 Newbridge Lane, Stockport.

Other competitors:—A Novice, Adolphus, Waverley, Bend Or, M. N. O. P., Nicholas Nickleby, Capt. Hedley Vicars, Edrude, Spes; Caractacus, Julius Cæsar, Euclid, Mani tien le Droit, Esrom, Tableau, X. Y. Z., St. Augustine, Discipulus, Traho, Iroquois.

THIRD YEAR—FEMALES.

No competitors.

FOURTH YEAR—MALES.

The prize, one pound, has in this division been awarded to

IMPERITUS.

William T. Stone, 17, Spring Cottages, Banbury.

Other competitors:—Caius, Mushroom, Hyacinth, Excelsior, Teacher V., Dominica, Euphonia, Augereua, Patriot, Dewi Saut, George Lee.

FOURTH YEAR—FEMALES.

The prize, one pound, has in this division been awarded to

DO WELL.

Mary Ann Kinsey, Pontnewynydd, Pontypool.

Other competitors:—Self-taught, Eschscholtzia.

DISQUALIFIED.

Anglo-Roman.

—o—

Publications Received.

Acoustics—
(1) Besant's Light, Heat, and Sound. 28, Stonecutter Street.

Algebra—
(1) MacKean's Algebra for Students. T. Nelson and Sons.

Analysis—
(1) Stoker's Analysis and Composition. W. Stewart and Co.

Arithmetic—
(1) Driver's Aid to Arithmetic. Griffith and Farran.

English Literature—
(1) Morrison's Byron's Childe Harold's Pilgrimage. Canto IV. Gall and Inglis.

Geography—
(1) Lord's Modern Europe. Simpkin, Marshall & Co.

Gymnastics—
(1) McCarthy's Easy System of Calisthenics. W. H. Allen and Co.

Kindergarten—
(1) Steele's Kindergarten Handbook. W. Stewart and Co.

Latin—
(1) Bell's Grammar School Classics. G. Bell and Son.

Miscellaneous—
(1) Fothergill's The Food we Eat. Griffith and Farran.

Music—
(1) Curwen's How to Read Music. Tonic Sol Fa Agency.

Periodical Literature—
(1) Ward and Lock's Universal Instructor. XVI. Ward, Lock and Co.
(2) Our Little Ones. IV. Griffith and Farran.

Reading Books—
(1) Jarrold's Empire Readers. Jarrold and Son.

Science—
(1) Shanton's Preparation for Science Teaching. Griffith and Farran.
(2) Danver's Science Ladders. Sampson Low and Co.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'*The Query Editor*,'
The Practical Teacher
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. R. B.—Simplify $\dfrac{2\times\sqrt{1+\frac{1}{3}}\div\sqrt{1-\frac{1}{3}}}{5\times\sqrt{1+\frac{1}{3}}\times\sqrt{1-\frac{1}{3}}}$.

$$\frac{2\times\sqrt{1+\frac{1}{3}}\div\sqrt{1-\frac{1}{3}}}{5\times\sqrt{1+\frac{1}{3}}\times\sqrt{1-\frac{1}{3}}}$$

$$=\frac{2\times\sqrt{\frac{4}{3}}\div\sqrt{\frac{2}{3}}}{5\times\sqrt{\frac{4}{3}}\times\sqrt{\frac{2}{3}}}$$

$$=\frac{2\times\sqrt{\frac{4}{3}\times\frac{3}{2}}}{5\times\sqrt{\frac{4}{3}\times\frac{2}{3}}}$$

$$=\frac{2\times\sqrt{\frac{4}{3}}}{5\times\sqrt{\frac{8}{9}}}$$

$$=\frac{2}{5}\times\sqrt{\frac{\frac{4}{3}}{\frac{8}{9}}}$$

$$=\frac{2}{5}\times\sqrt{\frac{4}{3}\times\frac{9}{8}}$$

$$=\frac{2}{5}\times\frac{3}{2}$$

$$=\frac{3}{5}.$$ Ans.

2. YELSERP.—A person buys 1000 qrs. of wheat at 54s. per quarter; he keeps it 7 months, during which time it loses in quantity 2½ per cent.; if money be worth 5 per cent. and his incidental expenses be £20, what does he gain or lose by selling the wheat at 58s. a quarter? (*Barnard Smith.*)

Cost of wheat = 54s. × 1000
= £2700

Interest on investment = $\frac{7}{12}$ of 5% on £2700
= $\frac{7}{12}$ of £135
= £78 15s.

Quantity of wheat remaining = (100 − 2½)% of 1000 qrs.
= 97½% of 1000 qrs.
= 975 qrs.

Selling price of wheat = 58s. × 975
= £2827 10s.

∴ Gain = £2827 10s. − (£2700 + £78 15s. + £20)
= £2827 10s. − £2798 15s.
= £28 15s. Ans.

3. SUSSEX.—If the increase in the number of male and female criminals be 1·8 per cent., while the decrease in the number of males alone is 4·6 per cent., and the increase in the number of females is 9·8 per cent., compare the number of male and female criminals respectively. (*Barnard Smith.*)

(No. of male and female criminals) × $\frac{1\cdot8}{100}$ = No. of female criminals × $\frac{9\cdot8}{100}$ − No. of male criminals × $\frac{4\cdot6}{100}$.

(No. of male and female criminals) × 1·8 = No. of female criminals × 9·8 — No. of male criminals × 4·6.

No. of male criminals × 1·8 + No. of female criminals × 1·8 = No. of female criminals × 9·8 — No. of male criminals × 4·6.

No. of male criminals × 1·8 + No. of male criminals × 4·6 = No. of female criminals × 9·8 — No. of female criminals × 1·8.

No. of male criminals × 6·4 = No. of female criminals × 8.

$$\frac{\text{No. of male criminals}}{\text{No. of female criminals}}=\frac{8}{6\cdot4}.$$

∴ No. of male criminals : No. of female criminals.
:: 8 : 6·4
:: 80 : 64
:: 5 : 4. Ans.

4. LITTLE DORRITT.—A person buys 50 reams of paper, which he thought to sell at £1 2s. 6d. per ream, making 8 per cent. profit on the prime cost; but five reams being damaged, what did he gain or lose per cent. by selling the remainder at the same rate? (*Todhunter.*)

Prime cost per ream = £1 2s. 6d. × $\frac{100}{108}$;
„ „ of 50 reams = £1 2s. 6d. × $\frac{100\times50}{108}$

$$=\left(\frac{9}{8}\times\frac{25\times50}{27}\right)£$$

$$=\frac{625}{12}£$$

= £52 1s. 8d.

Selling price of 45 reams = £1 2s. 6d. × 45
= £50 12s. 6d.

Loss = £52 1s. 8d. − £50 12s. 6d.
= £1 9s. 2d.

£	s.	d.		£	£	s.	d.	
52	1	8	:	100	:: 1	9	2	: Loss %
20					20			
1041					29			
12					12			
12500					348			
5					14			

$= 2\frac{4}{5}\%$ loss. Ans.

5. FIDUS ACHATES.—At what rate per cent. will the discount on £1336 11s. 3d., due at the end of $3\frac{1}{2}$ years, amount to £199 1s. 3d.? (*Evers.*)

Present worth = £1336 11s. 3d. − £199 1s. 3d.
= £1137 10s.

£	£		£	
1137½	100			
yrs.	yrs.	::	199 1/16	: Rate %
3½	1		16	
			1195	
			199	
			3185	
			5	

$= \frac{7 \times 200 \times 2 \times 3185}{2277 \times 7 \times 16} £$

$= 5\%$. Ans.

6. URSULA.—Simplify

$$\tfrac{3}{8}(6\tfrac{2}{3}+2\tfrac{1}{2})£ + \left(\frac{2\frac{1}{2}-\frac{3}{8}\text{ of }1\frac{5}{6}}{\frac{1}{2}\text{ of }3\frac{1}{2}+\frac{13}{36}} \times \text{·95 of 5s.}\right) + \frac{16\cdot8}{\cdot024}\text{d.}$$

$$\tfrac{3}{8}(6\tfrac{2}{3}+2\tfrac{1}{2})£ + \left(\frac{2\frac{1}{2}-\frac{3}{8}\text{ of }1\frac{5}{6}}{\frac{1}{2}\text{ of }3\frac{1}{2}+\frac{13}{36}} \times \text{·95 of 5s.}\right) + \frac{16\cdot8}{\cdot024}\text{d.}$$

$$= \tfrac{3}{8}(\tfrac{20}{3}+\tfrac{5}{2})£ + \left(\frac{\frac{9}{4}-\frac{3}{8}\text{ of }\frac{11}{6}}{\frac{1}{8}\text{ of }\frac{200}{3}+\frac{13}{36}} \times \tfrac{19}{20}\text{ of 5s.}\right) + 700\text{d.}$$

$$= \tfrac{3}{8}\left(\frac{40+15}{6}\right)£ + \left(\frac{\frac{9}{4}-\frac{11}{8}}{\frac{25}{36}+\frac{13}{36}} \times \tfrac{19}{4}\right)\text{s.} + 700\text{d.}$$

$$= \left(\tfrac{11}{3}\text{ of }\frac{55}{8}\right)£ + \left(\frac{81-44}{36}\times\tfrac{19}{4}\right)\text{s.} + 700\text{d.}$$

$$= \tfrac{77}{8}£ + \left(\frac{37}{36}\times\tfrac{19}{4}\right)\text{s.} + 700\text{d.}$$

= £3 13s. 4d. + 4s. 9d. + £2 18s. 4d.
= £6 16s. 5d. Ans.

7. JACQUES.—A hare starts 40 yards before a greyhound and is not seen by him till she has been up 30 seconds. The hare runs at the rate of 12 and the hound at the rate of 15 miles per hour. How long will the chase last, and what distance will the hound have run? (*Brooke Smith.*)

Distance run by hare before she is seen by hound
$= \frac{30}{60\times60}$ of 12 miles
$= \frac{1}{10}$ mile
= 176 yards.

∴ The hare is (176 + 40) or 216 yards before hound.
The hound gains three miles in an hour;

∴ The chase lasts $\frac{216}{3\times1760}$ of an hour
$= (\frac{9}{220}\text{ of }\frac{60}{1})$ min.
$= \frac{27}{11}$ min.
$= 2$ min. $27\frac{5}{11}$ sec.

∴ Distance run by hound $= (\frac{9}{220}\times15\times1760)$ yds.
= 1080 yards. Ans.

8. T. W., Oswestry.—I bought 100 cards for 9s. 2d., and sold the lot so as to gain $\frac{2}{9}$ of the selling price. Find the selling price and my gain per cent.

Selling price = cost price + $\frac{2}{9}$ of selling price
$\frac{7}{9}$ Selling price = cost price
∴ Selling price = $\frac{9}{7}$ cost price
$= \frac{9}{7}$ of 9s. 2d.
$= \left(\frac{9}{7}\text{ of }\frac{55}{6}\right)$ s.
$= 14$s. 8d.

s.	d.		£	s.	d.
9	2	:	100	:: 5	6 : gain %.
12			12		
110			600		
			6		

= 60% gain. Ans.

9. SUBSCRIBER.—A beats B 3 yards in a race of 300; C can beat B $9\frac{3}{4}$ yards in same distance; by how much should C beat A in a mile race?

A runs 300 yds. while B runs 297 yds.,
and C " " " " " " $290\frac{1}{4}$ "

yds.		yds.		yds.	
297	:	290¼	:: 300	:	Distance run by A while
11		4	75		C runs 300 yds.
		1161			
		43			

$= \frac{43}{44}$ yds. $= 293\frac{3}{11}$ yds.

yds.		yds.		yds.	
300	:	$293\frac{3}{11}$	::	$6\frac{8}{11}$	: Distance C should beat A in a mile.
				40	
				280	

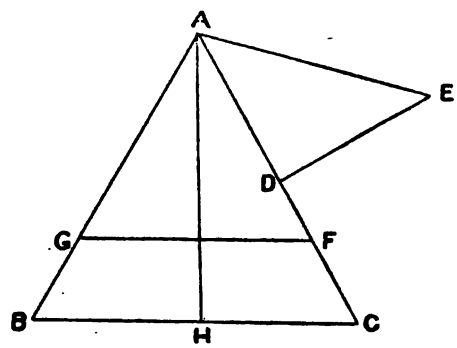
$= \frac{280\times7}{300\times11}$ yds.

$= \frac{4}{11}$ yds. $= \frac{40}{11}$ yards. Ans.

Geometry.

1. NORMAN.—Bisect an equilateral triangle by a line drawn parallel to the base, using only *first* book of Euclid.

Let ABC be the equilateral triangle.



Construction.—Bisect AC in D, and at D draw DE at right angles to AC, and equal to AD. Join AE, and from AC cut off AF, equal to AE. Through F draw FG parallel to BC.

Then GF shall bisect the equilateral triangle ABC. Draw AH perpendicular to BC.

Proof.—Area of triangle ABC = the rect. AH, HC (I. 41). Now AC = 2 HC.

If, therefore, AC contains m units, HC will contain $\frac{m}{2}$ units, and if AH contain x units,

$$x^2 + \left(\frac{m}{2}\right)^2 = m^2 \text{ (I. 47)},$$

$$x^2 + \frac{m^2}{4} = m^2, \quad \therefore x^2 = m^2 - \frac{m^2}{4} = \frac{3m^2}{4};$$

$$\therefore x = \frac{m}{2}\sqrt{3}.$$

$\therefore$ area of triangle ABC $= \frac{m}{2} \times \frac{m}{2}\sqrt{3}$

$= \frac{m^2}{4}\sqrt{3} = \frac{\sqrt{3}}{4} m^2$.

In like manner, the area of triangle AGF, which is also an equilateral triangle $= \frac{\sqrt{3}}{4} \times AF^2$.

But $AF^2 = AE^2 = AD^2 + DE^2$ (I. 47) $= 2\,AD^2$.

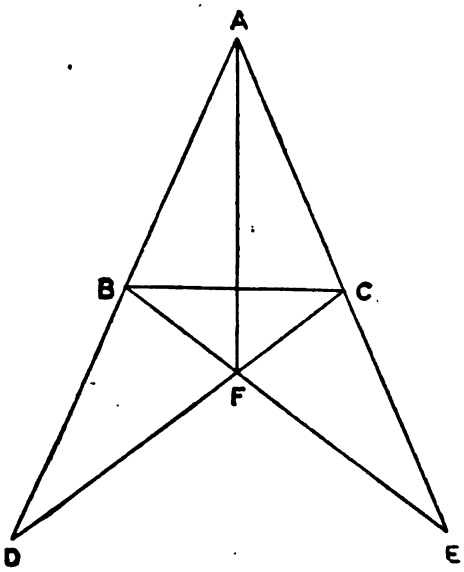
$= 2 \times \left(\frac{m}{2}\right)^2 = \frac{m^2}{2}$.

$\therefore$ area of AGF is half of area of ABC.

Wherefore the straight line GF drawn parallel to BC bisects the equilateral triangle ABC.—Q.E.F.

Note.—The general method of bisecting a triangle by a line drawn parallel to one of the sides is given in last issue, but the proof depends on the *sixth* book of Euclid.

2. S.T.H.—Prop. V. AB = BD, AC = CE. Join BE, CD. Prove DF = twice FC, or EF = ,, FB. Join AF.



Proof.—$\triangle$ BFD = $\triangle$ AFB (I. 38).

$\therefore$ twice $\triangle$ BFD = twice $\triangle$ AFB

$= \triangle$ ABC + $\triangle$ FBC;

And $\triangle$ ABC = $\triangle$ BCD (I. 38).

$= \triangle$ BFD + $\triangle$ FBC;

$\therefore$ twice $\triangle$ BFD = $\triangle$ BFD + twice $\triangle$ FBC,

$\therefore$ $\triangle$ BFD = twice $\triangle$ FBC (Ax. 3).

These triangles are between the same parallels.

$\therefore$ base DF = twice base FC.—Q.E.D.

Mensuration.

1. J. HOLLOWAY, Tring.—A cask, weighing 2 cwt. 12 lb. 4 oz., floats in a cubical cistern of water, whose side is 5 ft.; on the removal of the cask, find how much the water will sink in the cistern, supposing a cubic foot of water to weigh 63 lbs.

Quantity of water displaced $= \frac{2 \text{ cwt. } 12 \text{ lbs. } 4 \text{ oz.}}{63 \text{ lbs.}}$ cub. ft.

$= \frac{236\frac{1}{4}}{63}$ cub. ft.

$= \frac{1025}{252}$,,

$= \frac{175}{36}$,,

Surface of cistern = 25 sq. ft.

$\therefore$ the water will sink $(\frac{175}{36} \div 25)$ ft.

$= \frac{7}{36}$ ft.

$= \frac{7}{3}$ in.

$= 2\frac{1}{3}$ in.

Algebra.

1. N. H. B.—Prove that $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$.

Let $\frac{a}{b} \div \frac{c}{d} = x$; then $\frac{a}{b} = x \times \frac{c}{d} = \frac{xc}{d}$;

$\therefore \frac{ad}{b} = xc$, and $\frac{ad}{bc} = x$.

$\therefore \frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$.

2. D. TURNER.—Suppose the distance between London and Edinburgh is 360 miles, and that one traveller starts from Edinburgh and travels at the rate of 10 miles an hour, while another starts at the same time from London, and travels at the rate of 8 miles an hour; it is required to know where they will meet. (Solution by Algebra.)

Let x = time when they meet in hours;

Then $10x$ = distance gone by traveller from Edinburgh in miles,

And $8x$ = ,, ,, ,, ,, London ,, ,,

$\therefore 10x + 8x = 360$

$18x = 360$

$\therefore x = 20$.

$\therefore$ Distance from Edinburgh = (10 × 20) miles.

= 200 miles.

3. G. HUGHES, Pembroke.—A certain number consists of two digits, and if the sum of the digits be added to $\frac{9}{16}$ of the number, the digits will have exchanged places. By what fraction of the number must the difference of the digits be multiplied that the result may be their product? (*Colenso.*)

Let x = digit in ten's place,

And y = ,, ,, unit's ,, ;

Then $10x+y$ = the No.

$\therefore x+y + \frac{9}{16}$ of $(10x+y) = 10y+x$

$\frac{9}{16}$ of $(10x+y) = 9y$

$\frac{1}{16}$ of $(10x+y) = y$

$10x+y = 16y$

$10x = 15y$

$2x = 3y$

$\therefore y = \frac{2x}{3}$.

$$\text{Multiplier} = \frac{xy}{x-y} = \frac{x \times \frac{2x}{3}}{x-\frac{2x}{3}} = \frac{\frac{2x^2}{3}}{\frac{x}{3}} = 2x.$$

$$\therefore \text{Fraction of No.} = \frac{2x}{10x+y} = \frac{2x}{10x+\frac{2x}{3}}$$

$$= \frac{6x}{32x} = \frac{3}{16} \text{ Ans.}$$

4. W. H. S.—Find G.C.M. of $x^3+a^2x^2$ and $x^3+x^2y+xy^2$.

$x^3+a^2x^2 = x^2(x+a^2)$.

$x^3+x^2y+xy^2 = x(x^2+xy+y^2)$.

$\therefore$ G.C.M. = x.

5. NERO, Pontypridd.—Prove that:—

$x^4+px^3+qx^2+rx+s$ is a complete square if $p^2s=r^2$ and $q=\frac{p^2}{4}+2\sqrt{s}$.

$$x^4+px^3+qx^2+rx+s\left(x^2+\frac{px}{2}+\frac{4q-p^2}{8}\right.$$

x^4

$2x^2+\frac{px}{2}$ | px^3+qx^2

$px^3+\frac{p^2x^2}{4}$

$2x^2+px+\frac{4q-p^2}{8}$ | $\left(q-\frac{p^2}{4}\right)x^2+rx+s.$

$\left(q-\frac{p^2}{4}\right)x^2+\frac{p(4q-p^2)}{8}x+\left(\frac{4q-p^2}{8}\right)^2$

$\therefore$ If the given quantity be a complete square,

r must equal $\frac{p(4q-p^2)}{8}$,

and s ,, ,, $\left(\frac{4q-p^2}{8}\right)^2$.

If $s = \left(\frac{4q - p^2}{8}\right)^2$

$\sqrt{s} = \frac{4q - p^2}{8}$.

$\therefore$ If $r = \frac{p(4q - p^2)}{8}$

$r = p\sqrt{s}$

$\therefore r^2 = p^2 s$.

and $\sqrt{s} = \frac{4q - p^2}{8}$

$8\sqrt{s} = 4q - p^2$

$4q = p^2 + 8\sqrt{s}$

$\therefore q = \frac{p^2}{4} + 2\sqrt{s}$.

6. W. PATON, Glasgow.—Prove that:—

$$1 - n + \frac{n \cdot n - 1}{1 \cdot 2} \ldots \text{ to } \overline{n+1} \text{ terms} = 0,$$

when n is a whole number.

(Certificate Examination, 1881.)

$$(1 - x)^n = 1 - nx + \frac{n(n-1)}{1 \cdot 2} x^2 - \ldots$$
$$+ n(-x)^{n-1} + (-x)^n.$$

Put $x = 1$; thus

$$(1 - 1)^n = 1 - n + \frac{n(n-1)}{1 \cdot 2} x^2 - \ldots$$
$$+ n(-1)^{n-1} + (-1)^n;$$

But $(1 - 1)^n = 0$,

$$\therefore 1 - n + \frac{n \cdot n + 1}{1 \cdot 2} \ldots \text{ to } \overline{n+1} \text{ terms} = 0.$$

When n is a whole number.

General.

1. W. ROBERTSON, Skeld.—Dr. Smith's Smaller Histories of Greece and Rome (*Murray*); Workman's 'Matriculation Questions, with Advice to Students' (*Hughes*); and Autenrieth's Homeric Dictionary (*Macmillan*) will probably be of service to you.

2. JUVENIS, Huddersfield.—You will find the Syllabus you ask for in the February issue of this journal. You might use Fitch's 'Lectures on Teaching' in addition to your other text-book.

3. J. S., Earls Heaton.—Dr. Johnson once said to Boswell, 'Sir, hell is paved with good intentions.' This is evidently the phrase to which you refer.

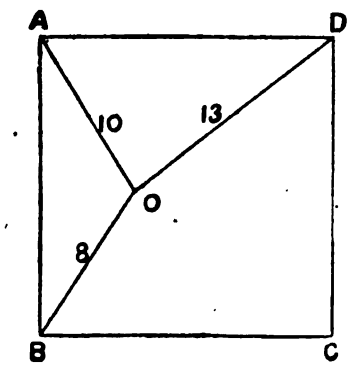
4. B. E. L.—Mr. Furness's admirable Variorum edition of 'Macbeth,' published by A. R. Smith, and price 15s., is the best you could get. You will find a cheaper one in the Clarendon Press series and in the Rugby editions.

5. EBOR.—Lyell's 'Geology' would suit your purpose.

6. DOMINICA, Cotmanhay.—See Query 14, January, '82, issue of our journal.

7. D. A., Nottingham, and GLACIER, Darwen, have forgotten to give their real names and addresses. Their queries will be answered on their doing so.

8. W. SEYMOUR, South Shields.—In a square garden a tree is so placed that its distances from three corners are 8, 10, and 13 perches, respectively; find the area of the garden.



Let ABCD be the garden, and O the position of the tree.
Then OB = 8, OA = 10, OD = 13.
Let the side of the garden = x,
Then the area " " $= x^2$.

$$\text{Sin BAO} = \frac{2}{AO \times AB}\sqrt{s(s-a)(s-b)(s-c)}$$

$$= \frac{2}{10x}\sqrt{\left(\frac{8+10+x}{2}\right)\left(\frac{18+x}{2}-8\right)\left(\frac{18+x}{2}-10\right)\left(\frac{18+x}{2}-x\right)}$$

$$= \frac{1}{5x}\sqrt{\frac{18+x}{2}\cdot\frac{x+2}{2}\cdot\frac{x-2}{2}\cdot\frac{18-x}{2}}$$

$$= \frac{1}{20x}\sqrt{(18+x)(18-x)(x+2)(x-2)}$$

$$= \frac{1}{20x}\sqrt{(324 - x^2)(x^2 - 4)}$$

$$\therefore \sin^2 \text{BAO} = \frac{328x^2 - x^4 - 1296}{400x^2}.$$

$$\text{Sin DAO} = \frac{2}{AO \times AD}\sqrt{s(s-a)(s-b)(s-c)} =$$

$$\frac{2}{10x}\sqrt{\left(\frac{10+13+x}{2}\right)\left(\frac{23+x}{2}-10\right)\left(\frac{23+x}{2}-13\right)\left(\frac{23+x}{2}-x\right)}$$

$$= \frac{1}{5x}\sqrt{\frac{23+x}{2}\cdot\frac{x+3}{2}\cdot\frac{x-3}{2}\cdot\frac{23-x}{2}}$$

$$= \frac{1}{20x}\sqrt{(23+x)(23-x)(x+3)(x-3)}$$

$$= \frac{1}{20x}\sqrt{(529 - x^2)(x^2 - 9)};$$

But sin DAO = cos (90° − DAO) = cos BAO:

$$\therefore \cos^2 \text{BAO} = \frac{538x^2 - x^4 - 4761}{400x^2}.$$

But $\sin^2 \text{BAO} + \cos^2 \text{BAO} = 1$.

$$\therefore \frac{328x^2 - x^4 - 1296}{400x^2} + \frac{538x^2 - x^4 - 4761}{400x^2} = 1$$

$$866x^2 - 2x^4 - 6057 = 400x^2$$

$$-2x^4 + 466x^2 = 6057$$

$$x^4 - 233x^2 + \left(\frac{233}{2}\right)^2 = \frac{54289}{4} - \frac{6057}{2}$$

$$= \frac{54289 - 12114}{4}$$

$$= \frac{42175}{4}$$

$$x^2 - \frac{233}{2} = \pm\frac{205{\cdot}3655\ldots}{2}$$

$$x^2 = \pm\frac{205{\cdot}3655\ldots}{2} + \frac{233}{2}$$

$$= \frac{438{\cdot}3655\ldots}{2} \text{ or } \frac{27{\cdot}434\ldots}{2}$$

$\therefore x^2 = 219{\cdot}1827\ldots$ or $13{\cdot}717\ldots$

It is evident that the value 13·717 is inapplicable.

$\therefore$ area of garden = 219·1827 perches.

= 1 ac. 1 ro. 19·1827 poles.

9. PUZZLED.—If you want us to answer your question, please be at the trouble to send it, and not refer us to *a book* where it may be seen.

10. LEIGH.—Hughes's Graduated Exercises in Arithmetic, or the same author's Government Inspection Cards.

11. JUNIUS.—You will find all the information you need in the Syllabus issued by the Science and Art Department.

12. INQUIRER.—The term 'Practical Geometry' shows that the problems have to be worked *practically*.

13. E. H. S.—We regret to state that your query must be held over till next month.

14. ANGLAIS.—It is quite possible to acquire a *grammatical* knowledge of French without a master. We should recommend you to use the 'Grammaire des Grammaires,' *Havet's* French Grammar, or *Chardenal's* Course.

15. GEPP.—We will, to oblige you, give eighty lines of *Burke's* Speech against Hastings in an early number of our new journal, 'The Scholar.' You can obtain a selection from Burke, published by the Clarendon Press, for about 3s. 6d.

16. A. L.—Prove that the equation $2y^2 - 3xy - 2x^2 - y + 2x = 0$ represents two straight lines which are perpendicular to each other; and that one of them passes through the point (1,2), and the other through the point $(2, -\frac{1}{2})$.

$$2y^2 - 3xy - 2x^2 - y + 2x = 0$$
$$2y^2 - 3xy - y = 2x^2 - 2x$$
$$y^2 - \frac{3x+1}{2}y + \left(\frac{3x+1}{4}\right)^2 = x^2 - x + \frac{9x^2+6x+1}{16}$$
$$= \frac{25x^2 - 10x + 1}{16}$$
$$y - \frac{3x+1}{4} = \pm\frac{5x-1}{4}$$
$$y = \pm\frac{5x-1}{4} + \frac{3x+1}{4}$$
$$\therefore y = 2x, \text{ or } -\tfrac{1}{2}x + \tfrac{1}{2}.$$

The equation $y = 2x$ represents a straight line passing through the point (1,2), and the equation $y = -\frac{1}{2}x + \frac{1}{2}$ represents a straight line passing through the point $(2, -\frac{1}{2})$.

Now, when the co-efficient of x in one equation is the negative reciprocal of the co-efficient of x in the other equation, the two straight lines are perpendicular to each other.

∴ The given equation represents two straight lines perpendicular to each other.

17. P. P.—Three consecutive angular points of a parallelogram are $(a, 0)$, (h, k), $(0, b)$, respectively; find the co-ordinates of the other angular point, and the equations to the diagonals.

The first angular point $(a, 0)$ is on the axis of x, and the third angular point $(0, b)$ is on the axis of y.

∴ It is evident that the co-ordinates of the fourth angular point are $(a-h)$, $(b-k)$.

The general equation to the straight line which passes through two given points is :—

$$(x_2 - x_1)(y - y_1) = (y_2 - y_1)(x - x_1).$$

The two given points for one diagonal are $(a, 0)$, $(0, b)$, and for the other (h, k), $\{(a-h), (b-k)\}$.

Equation for one diagonal :—

$$-ay = b(x - a)$$
$$-ay = bx - ab$$
$$bx + ay = ab$$
$$\therefore \frac{x}{a} + \frac{y}{b} = 1.$$

Equation for the other diagonal :—

$$(a-h-k)(y-k) = (b-k-k)(x-h)$$
$$\therefore (y-k)(a-2k) = (x-h)(b-2k).$$

18. T. A. MUMMERY, Folkestone.—Find the area of a regular polygon of 24 sides inscribed in a circle, the radius of which is one foot.

In a regular polygon of n sides inscribed in a circle of radius r,

$$\text{Area} = \frac{n}{2}r^2 \sin\frac{360^\circ}{n}.$$

$$\therefore \text{Area of polygon} = \left(\frac{24}{2}\sin\frac{360^\circ}{24}\right) \text{sq. ft.}$$
$$= (12 \sin 15^\circ) \quad ,,$$
$$= (12 \times \cdot 258819) \quad ,,$$
$$= 3\cdot 105828 \text{ sq. ft.}$$

19. GULLIVER.—Dr. Morrison's (Gall and Inglis.) The National Society also publish a manual on the subject.

20. E. JENKINS, Pontardawe.—Consult the 'Science Directory,' which may be had through any bookseller.

21. EUREKA.—No, but if you have difficulty with any particular question, we shall be happy to help you in the *Query Column*. No answers are published.

22. ALPHA.—Write to Mr. J. Strugnell, National Society's Depository, Westminster.

23. PUZZLED.—We only answer *one* question at a time. Get (*a*) Gardner's 'How to Draw a Map,' (*b*) Johnston's 'Atlas.'

24. IGNARUS.—Grammarians differ. No examiner would reject an intelligent answer.

25. P. T., Macclesfield.—Yes.

26. THREE OF US.—Write to Longmans and Co. for their 'Civil Service Guide.'

27. J. S. M.—You can take which year you prefer.

28. G. GUPPY.—*Année* represents duration.

29. JEMMY JOHNSON.—By all means sit for scholarship. Write to Messrs. Longmans for their 'Civil Service Guide.'

30. SEVERN.—(*a*) No syllabus issued. See questions in previous Nos. of PRACTICAL TEACHER. (*b*) Application should be made at once. (*c*) Writing and composition *good*.

31. J. E. ROWLEY.—No paper issued. Avail yourself of our *Query Column*.

32. W. H. G.—(*a*) Right style—high percentage. (*b*) Most probably.

33. PUPIL TEACHER.—The trade does not know the book, which is probably out of print.

34. CURIOUS.—The word you mention occurs in Mr. Tennyson's 'Dream of Fair Women':—

> 'Moreover, it is written that my race
> Hew'd Ammon, hip and thigh, from Aroer
> On Arnon unto Minneth.'

Aroer was a town by the bank of the river Arnon. See the 2nd and 3rd chapters of the Deuteronomy of Moses. We should advise you to give a spare moment to your spelling. Most people do *not* make *oblidge* spell oblige.

35. PARADOX.—A weight is just supported on a rough inclined plane of inclination α by a force P acting parallel to the plane. If the inclination be changed to $\frac{\pi}{2} - \alpha$, a force 2P is required to support it. Prove that, $\cos(\alpha + \lambda) = 2\sin(\alpha - \lambda)\tan\lambda$ being the co-efficient of friction.

$$(1)\ P = W\frac{\sin(\alpha - \lambda)}{\cos\lambda}$$

$$(2)\ P = W\frac{\sin\left(\frac{\pi}{2} - \alpha - \lambda\right)}{\cos\lambda},$$

Dividing (1) by (2),

$$\frac{1}{2} = \frac{\sin(\alpha - \lambda)}{\sin\left(\frac{\pi}{2} - \alpha - \lambda\right)}$$

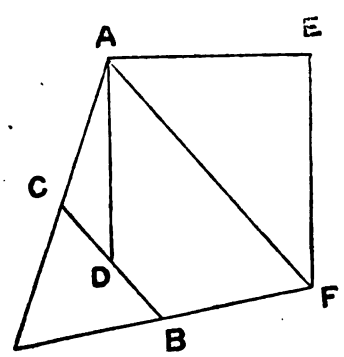
$$\text{But, } \sin\left(\frac{\pi}{2} - \alpha - \lambda\right) = \cos(\alpha + \lambda)$$

$$\frac{1}{2} = \frac{\sin(\alpha - \lambda)}{\cos(\alpha + \lambda)}$$

$$\therefore \cos(\alpha + \lambda) = 2\sin(\alpha - \lambda).$$

36. Αλφα.—A heavy wire is bent at its middle point, so as to contain an angle of 60°; it is suspended from one of its ends; find its position in equilibrium. (Magnus' 'Mechanics.')

If C and B be the middle points of the two parts, and CB be bisected in D, D must be vertically under A the point of suspension. The position of the wire may be found by drawing a horizontal line through A, and marking off a distance AE equal to $\sqrt{\frac{1}{7}}$ of a, where a is the length of half the wire, and then dropping a vertical EF equal to $\frac{2}{\sqrt{7}}$ of a. If AF be joined and an equilateral triangle described on it, the two sides will be the position of the wire.



The lengths of AE and EF are calculated thus:—
In the triangle ACD—

$$AD^2 = AC^2 + CD^2 - 2\,AC.CD\cos ACD$$
$$= \left(\frac{a}{2}\right)^2 + \left(\frac{a}{4}\right)^2 - 2\times\frac{a}{2}\times\frac{a}{4}\times\cos 120^\circ$$
$$= \frac{a^2}{4} + \frac{a^2}{16} - \left(\frac{a^2}{4}\times -\cos 60^\circ\right)$$
$$= \frac{5a^2}{16} - \left(\frac{a^2}{4}\times -\tfrac{1}{2}\right)$$
$$= \frac{5a^2}{16} + \frac{a^2}{8}$$
$$= \frac{7a^2}{16};$$
$$\therefore AD = \frac{a}{4}\sqrt{7}$$
$$\sin ADC : \sin ACD :: AC : AD$$
$$\sin ADC : \sin 120^\circ :: \frac{a}{2} : \frac{a}{4}\sqrt{7}$$
$$\sin ADC : \frac{\sqrt{3}}{2} :: 2 : \sqrt{7}$$
$$\therefore \sin ADC = \sqrt{\tfrac{3}{7}}.$$

But $\angle FAD = \angle ADC$ (I. 29),
And $\angle EAF$ = complement of $\angle FAD$.
$$\therefore \cos EAF = \sin ADC = \sqrt{\tfrac{3}{7}};$$
$$\text{But } \cos EAF = \frac{AE}{AF}.$$
$$\therefore \frac{AE}{AF} = \sqrt{\tfrac{3}{7}}$$
$$\frac{AE}{a} = \sqrt{\tfrac{3}{7}}$$
$$\therefore AE = a\sqrt{\tfrac{3}{7}}.$$
$$AF^2 = AE^2 + EF^2 \text{ (I. 47)}$$
$$a^2 = \left(a\sqrt{\tfrac{3}{7}}\right)^2 + EF^2$$
$$= \frac{3a^2}{7} + EF^2$$
$$\frac{4a^2}{7} = EF^2$$
$$\therefore EF = \frac{2a}{\sqrt{7}}.$$

37. NORMAN H.—No. 1 query in Geometry is to bisect *any* triangle by a line drawn parallel to one side. Your query is a particular case, and can be solved in the same way, or thus:—Bisect AC, one of the sides of the equilateral triangle in D, and erect the perpendicular DE=AD. Join AE, and with centre A and radius AE describe an arc cutting AC in F. Through F draw FG parallel to BC. Then AGF shall be half the triangle ABC. It can be proved by the same method as the general case.

In the deduction you refer to it would have been preferable to prove that AE falls nearer to AC, the greater side, than AD. The proof is very simple.

38. SPHINX, Cornwall.—*θάνω* from *θνήσκω*, active voice, subjunctive mood, 2nd aorist, first person singular; *ἦσω* for *ἴσω*, Homeric for *αἷς* (see smaller Liddell and Scott, page 487), dative feminine plural; *ἀνέσχετο* from *ἀνέχω* (Liddell and Scott, page 60), 2nd aorist, middle voice, indicative mood, 3rd singular; *πεῖθοντο*, augment dropped—usual with Homer,—from *πείθω* (Liddell and Scott, 523), passive voice, indicative mood, imperfect tense, 3rd plural; *ἔπιντο* (see Liddell and Scott, 256) from *ἕπω*, middle *ἕπομαι*, imperfect, *sine* augment; *ἐπόμην*, middle voice, indicative mood, imperfect tense, 3rd plural,

—o—

Training Colleges.

GENERAL EXAMINATION, 1881.

SECOND YEAR.—(*continued.*)

MALE CANDIDATES.

Geography.

Two hours and a half allowed for this Paper.

Every candidate must draw one of the maps in Question 1. Not more than *seven* of the other questions may be answered.

1. Draw a map of—
   (*a*) Ireland.
   Or (*b*) British North America.
   Or (*c*) The Colonies of Queensland, New South Wales, and Victoria.

N.B.—Each map should be drawn on a scale sufficient to occupy all the blank space available. If the candidate put in, and correctly number the lines of latitude and longitude, it will add to the value of the exercise.

Places must not be indicated by letters or figures, referring to a list of names at the side, but *the names themselves must be inserted in the map.*

2. Show that the coast of England is generally bold and deeply indented, and name the districts which present especial exceptions to this statement.

3. Describe the positions of, and the historical associations connected with, St. Albans, Ely, Tewkesbury, Torbay, Stirling, Glencoe, and Carnarvon.

4. Name the counties in which the towns of Preston, Wakefield, Dundee, Coventry, Bolton, Belfast, Paisley, Halifax, Dudley, and Stroud are situated, and state the principal industries of each district.

5. 'The rivers of Scotland are navigable only for short distances, but possess wide estuaries.'

Explain the physical character of the country in its bearing upon this statement.

6. 'No part of Ireland is more than sixty miles distant from some inlet of salt water.'

Explain this statement and name some of the principal inlets.

7. Describe fully the great central plain of Ireland.

8. Describe the position of Aden, Lagos, Singapore, and Barbadoes, and gives the dates and circumstances of their being annexed to the British Empire.

9. Name the chief plains and plateaux of Hindustan, and give a brief description of the most southerly plateau.

10. Give some of the historical associations connected with Benares, Lahore, Seringapatam, Plassy, Arcot, and Lucknow.

11. Enumerate the chief exports of Natal, Queensland, and Jamaica.

12. Name the principal rivers of the Canadian Dominion, the towns on their banks, and the seas into which they flow.

13. Describe briefly a voyage by sea from London to Cape Town, Galle, and Calcutta.

14. Give some account of the climate, the native race, and the chief productions of New Zealand.

15. Describe fully the boundaries and physical features of Western Australia.

Euclid.

Three hours allowed for this Paper.

(Not more than *nine* questions to be answered.)

N.B.—Capital letters, not numbers, must be used in the diagrams.

The only signs allowed are + and =. The square on AB may be written 'sq. on AB,' and the rectangle contained by AB and CD, 'rect. AB, CD.' Other abbreviations, if employed, must not be ambiguous.

1. If two triangles have two angles of the one equal to two angles of the other, each to each, and the sides adjacent to the equal angles in each equal the third angle of the one shall be equal to the third angle of the other.

In the equilateral triangle ABC, BD, and CE, which bisect the angles at B, C, intersect each other in O and the opposite sides in D, E; show that OD=OE.

2. To divide a given straight line into two parts so that the difference of the squares on the whole line and on one of the parts may be equal to a given rectangle, which is not greater than the square on the whole line.

3. If a straight line touch a circle the straight line drawn from the centre to the point of contact shall be perpendicular to the line touching the circle.

Find the locus of the points, from which tangents can be drawn to a given circle equal to its radius.

4. To draw a chord through a given point within a given circle that shall be equal to a given line.

Show that this is only possible within certain limits, and draw the longest and shortest chords that can be drawn through the point.

5. In a circle the angle in a semicircle is a right angle.

The circle ABC passes through the centre of the circle DBC; find the point of intersection of the tangents to DBC at the points BC.

6. In equal circles, the angles which stand upon equal arcs are equal to one another, whether they be at the centres or circumferences.

Show that the arcs subtended by one of the angles of an equilateral triangle, and by one of the smaller angles of a right angled isosceles triangle, which are inscribed in a circle, are in the ration of 4 : 3.

7. If from any point without a circle two straight lines be drawn, one of which cuts the circle but does not pass through the centre, and the other touches it, the rectangle contained by the whole line, which cuts the circle and the part of it without the circle, shall be equal to the square on the line which touches it.

If perpendiculars BD, CE be drawn from the angular points, B, C of the triangle ABC upon the opposite sides, show that the rectangle contained by AB and AE is equal to the rectangle contained by AC and AD.

8. In a given circle inscribe a triangle equiangular to a given triangle.

If the given triangle be equilateral and its base equal to the radius of the circle, compare the areas of the two triangles.

9. To inscribe an equilateral and equiangular pentagon in a given circle.

Show that the line drawn from the apex of the isosceles triangle, required in the figure, to the intersection of the lines bisecting the angles at the base, is greater than the radius of the circle.

10. The sides about the equal angles of triangles which are equiangular to one another are proportional.

11. In a right angled triangle, if a perpendicular be drawn from the right angle to the base, the triangles on each side of it are similar to one another.

If the segments of the base are in the ratio of 4 : 1, find the ratio of the squares on the sides.

12. Two circles ABC and ABD, intersect in A, B, show that the tangent to ABD at A cannot be parallel to the tangent to ABC at B, unless the circles are equal.

13. Two equal circles touch another circle externally at the extremeties of a diameter: if the radius of the latter circle be double of the radius of the others, compare the areas of the squares constructed on the diagonals of the rhombus formed by the common tangents to the circles.

14. To find a point without two given circles from which four equal tangents of given length can be drawn to the two circles.

15. Show that the circle which passes through the middle points of the side of a triangle passes through the feet of the perpendiculars from the angles upon the opposite sides.

Algebra and Mensuration.

Three hours allowed for this Paper.

Candidates are not permitted to answer more than *twelve* of these questions.

The *solution* must be given at such length as to be intelligible to the Examiner, otherwise the answer will be considered of no value.

[NOTE.—In all problems, where required, the circumference of a circle may be assumed to be=$(\frac{22}{7})$ths of the diameter. Not more than 2 decimal places are required in the answers.]

1. Prove the rule for converting mixed circulating decimals to vulgar fractions.

2. If y varies as x^2 and $y = 5$, when $x=4$, find the value of x when $y=125$.

3. If x, y, z are in harmonical progression, then $\frac{x}{y+z}, \frac{y}{x+z}, \frac{z}{x+y}$ are also in harmonical progression.

4. Solve the equations—

$$\left.\begin{aligned} \frac{1}{x}+\frac{3}{y}&=\frac{3}{2} \\ \frac{3}{x}+\frac{7}{y}&=\frac{23}{6} \end{aligned}\right\} \text{(1.)}$$

$$\left.\begin{aligned} x^2-y^2&=75 \\ xy&=154 \end{aligned}\right\} \text{(2.)}$$

5. Show that x^2+y^2 is never less than $2xy$ and $x+\frac{1}{x}$ is never less than 2, when x and y are real and positive.

6. Find the co-efficient of x^4 in the expansion of $(1-x^2+x^3)^3$; and prove that $1-n+\frac{n.n-1}{1.2}$ .. to $\overline{n+1}$ terms=0, when n is a whole number.

7. Show that the number of combinations of n things taken r together is the same as the number of combinations taken $n-r$ together. Show that a greater number of words containing 8 letters can be formed out of 12 letters than of words which contain only 3.

8. When $n+1$ figures of a square root have been found by the usual method, show that n more can be obtained by division only; and find the square root of 3 to four places of decimals.

9. If a, b be employed as bases of logarithms, show that $\log_b M=\log_b a \times \log_a M$. Given log. 15=1.1760913, log. 2=.3010300, find log. 3, log. 225, and log. $\sqrt{75}$.

10. Find a formula to express the present value of an annuity, to commence at the end of m years and then to continue n years.

11. The sum of four numbers in arithmetical progression is $19\frac{1}{2}$, and the sum of the products taken two and two together is $138\frac{11}{16}$; find the numbers.

12. Given n straight lines, of which no three pass through the same point and only two are parallel, find the number of intersections of the lines.

13. Find in chains the area of the largest rectangle that can be enclosed by 240 hurdles each 18 feet long.

14. Find the radius of a hollow sphere which is an inch thick, and contains the same amount of gold as a solid sphere whose radius is 7 inches.

15. The sides of a right-angled triangle are in arithmetical progression and its area is 150 feet; find its sides.

16. The densities of two similar cones vary directly as the squares of their heights, find the height of the larger cone weighing 216 times as much as the smaller, which has a height of six feet.

Political Economy.

Three hours allowed for this Paper.

Candidates are not permitted to answer more than eight questions.

1. Explain the term 'Social Economy,' showing especially that it is wider in application than the science of political economy,

2. Distinguish 'productive' and 'unproductive labour.' Under which of the two heads would you place the construction and maintenance of a park for the people, the labour of railway servants employed in pleasure traffic on Sundays, and the duties of over-lookers of labour? Give your reasons.

3. Give approximately the amount of the English public debt; explain the term Consols, and give some reasons for the price of Consols in 1881.

4. Explain the terms 'Fair Trade,' Free Trade,' 'Reciprocity,' and 'Most favoured nations clauses' in treaties of commerce.

5. Explain generally how a large increase in our carrying trade and foreign investments may have effected the relative amounts of exports and imports in the sum total of English commerce.

6. Show the effects of a bad harvest at home on the home trade and manufactures.

7. State some of the chief advantages and disadvantages of a bi-metallic system of coinage.

8. Show generally what effect the growth of a large manufacturing town has upon the value of land in the immediate neighbourhood.

9. Point out the chief advantages which enable a farmer in the West of America to compete with the English farmer in the home market.

10. What data would be required for determining whether an agricultural labourer earning 15s. a week is in a better or worse position than a labourer in a large town earning 25s. a week?

11. Give reasons showing that each trade tends to have a certain rate of profit, and account for the difference of the rates of profit in a large co-operative store and in a shop in a country village.

12. Distinguish between saving and parsimonious habits; name some of the safest modes of investing small savings, and account for the variation in the amounts of interest to be fairly expected in each that you have named.

13. Show the advantages of co-operation between the capitalist and his workmen in obviating disputes about wages and recourse to arbitration.

14. Discuss the question whether a high rate of interest is compatible with security of investment.

15. Enumerate the principal articles that have been totally or partially relieved from taxation in the present reign, and explain the principles on which a high rate of duty is still leived on certain articles.

FIRST YEAR.

MALE CANDIDATES.

Mental Arithmetic.

N.B.—Do not turn this paper till you are told to do so.

Twenty minutes allowed for this Paper.

You are to enter the answer in the space ( ) left for it after each question. Nothing is to be written on this paper, except the particulars required in the above table, and the answers (which must be written in ink) to the questions on the other side. No erasures or alterations are permitted. They will be marked as errors.

1. $(6017+1008)-(4018+1007)=$
2. $1007\times1009=$
3. $\frac{1}{17}$ of $3\cdot5\times4\frac{1}{2}=$
4. Goods bought for 1s. 7½d. sold for 2s. 2d., the gain per cent.=
5. $13^3-13^2-12^2=$
6. If 12 score cost £11 5s., the price of one article=
7. The number of francs, at 10d. each, in 50 guineas=
8. The real value of £1,000 in the 3 per cent. stocks when an investment produces 2¾ per cent.=
9. Compound interest on £250 for 3 years at 20 per cent.=
10. The number of cubic feet in a box 5½ feet long, 4½ feet broad, 16 inches deep.
11. The prime numbers in 289289 are=
12. The average of 2023, 2045, 2075, 3017=
13. The accommodation of a school 56 feet long, 20 feet broad, 12 feet high, at 80 cubic feet per child=
14. The remainder of $(7365\times5087)\div9=$

Alternative Paper.

1. If 13 score cost £16 5s., the price of one article=
2. The number of francs, at 10d. each, in 40 guineas=
3. The number of cubic feet in a box 4½ feet long, 3¼ feet broad, 8 inches deep=
4. $(7018+2009)-(6019)+2008)=$
5. The remainder of $(9875\times4089)\div9=$
6. Compound interest on £640 for 3 years at 25 per cent. =
7. The average of 1017, 1025, 1095, 2833 =
8. The accommodation of a school 60 feet long, 19 feet broad, 16 feet high, at 80 cubic feet per child =
9. $\frac{1}{13}$ of $5\cdot3\times5\frac{1}{2}=$
10. Goods bought for 1s. 10½d. sold for 2s. 1d., the gain per cent.=
11. $1003\times1005=$
12. The real value of £700 in the 4 per cent. stocks when an investment produces 3½ per cent. =
12. The prime numbers in 169169 are =
14. $14^3-13^2-13^2=$

FIRST AND SECOND YEARS.

MALE CANDIDATES.

Dictation and Penmanship.

Twenty minutes allowed for these Exercises.

Candidates are not to *paint* their letters in the *Copy-setting Exercise*, but to take care that the copy is clean and without erasures.

Omission and erasures in the *Dictation Exercise* will be counted as mistakes.

The words must not be divided between two lines; there is plenty of room for the passage to be written.

Write in large hand, as a specimen of Penmanship, the word *Insuperable.*

Write in small hand, as a specimen of Penmanship, the sentence—

Revenge is a kind of wild justice.

Dictation.

Write the passage dictated to you by the Examiner.

(For the Examiner.)

One passage is given for Candidates of both Years.

The passage should be read *once* distinctly, and then dictated *once*, in portions as marked.

If the room is large, and there is danger of your not being heard at its extremity, you may permit one of the officers of the College to stand half-way down the room, and repeat the words after you, exactly as you give them out.

It is essential that there be no complaint on the part of the Candidates that they could not hear or understand: you can prevent this only by clearness, accuracy, and audibility.

The characteristic result | of this Monarch's policy | was the consolidation of Western society. | His imperial schemes | give place to a growing feudalism, | in which independent chieftains | sub-divide the imperial domains, | forming political organisations | with some degree of central activity, | and replacing the shapeless chaos | of previous centuries. | In a life recklessly active | he reformed the coinage, | collected libraries, interfered in religious controversies, | attempted the magnificent enterprise | of uniting the Rhine and the Danube, | and meditated the task of moulding the discordant Codes | of Roman and barbarian laws | into an uniform system. |

FIRST YEAR.

MALE AND FEMALE CANDIDATES.

Languages.

Four hours allowed for this paper.

Male candidates may answer questions in *two* languages, Female candidates in *one* only.

Latin.

SECTION I.

1. Translate into English—

(*a*) Prima luce, confirmata re ab exploratoribus, omnem equitatum qui novissimum agmen moraretur præmisit.

(*b*) Titus Labienus castris hostium potitus et ex loco superiore quæ res in nostris castris gereretur conspicatus decimam legionem subsidio nostris misit. Qui cum ex equitum et calonum fuga quo in loco res esset quantoque in periculo et castra et legiones et imperator versaretur cognovissent nihil ad celeritatem sibi reliqui fecerunt.

2, Parse moraretur, castris, gereretur, subsidio, cognovissent, reliqui, sibi.

3. Translate into English—

Instructo exercitu, magis ut loci natura dejectusque collis et necessitas temporis, quam ut rei militaris ratio atque ordo postulabat, quum diversis legionibus abæ alia in parte hostibus resisterent, sepibusque densissimis, ut ante demonstravimus, interjectis prospectus impediretur, neque certa subsidia collocari, neque quid in quaque parta opus esset provideri, neque ab uno omnia imperia administrari poterant. Itaque in tanta rerum iniquitate fortunæ quoque eventus varii sequebantur.

Explain the subjunctive moods in this passage. Account for the case of "diversis legionibus." Might the structure of this sentence have been different?

Greek.

SECTION I.

1. Translate into English:—

(*a*) *Εἰ δὲ δὴ καὶ μανέντες σὲ κατακτείναιμεν, ἄλλο τι ἂν ἢ τὸν ἐνεργέτην κατακτείναντες πρὸς βασιλέα τὸν μέγιστον ἔφεδρον ἀγωνιζοίμεθα.*

(*b*) *Καὶ γὰρ οὖν φιγίδα μὲν καὶ εἰνολᾶ ἑπομένανς οὐδέποτ' εἶχεν· οἵτινες δὲ ἢ ὑπὸ πόλεως τεταγμένοι ἢ ὑπὸ τοῦ δεῖσθαι ἢ ἄλλῃ τινὶ ἀνάγκῃ κατεχόμενοι παρείησαν αὐτῷ σφόδρα πευφομένοις ἐχρῆτο.*

2. Parse *μανέντες εἶχεν, τεταγλένοι παρείησαν, ἐχρῆτο.*

3. Translate into English :—

Νεανίσκος δέ τις τῶν παρόντων ἐννοήσας εἶπεν, ὡς οὐκ ἀκόλουθα εἴη τό τε ἐπιθήσεσθαι καὶ το λύσειν τὴν λέφυραν. Δῆλον γὰρ ὅτι ἐπιτιθεμένους ἢ νικᾷν δεήσει ἢ ἡττᾶσθαι. Ἐὰν μὲν οὖν νικῶσι, τί δεῖ αὐτοὺς λύειν τὴν γεφυραν; οὐδὲ γὰρ, ἂν πολλαὶ γέφυραι ὦσιν, ἔχομεν ἂν ὅποι φυγόντες ἡμεῖς σωθεῖμεν. Ἐὰν δὲ ἡμεῖς νικῶμεν, λελυμένης τῆς γεφύρας οὐχ ἕξουσιν ἐκεῖνοι ὅποι φύγωσιν· οὐδέ μὴν βοηθῆσαι πολλῶν ὄντων μέραν, οὐδεὶς οὐτοῖς δυνήσεται, λελυμένης τῆς γεφύρας.

Latin.

SECTION II.

Translate into Latin—

(*a*) I hope to come to you to-morrow.
They concealed their crimes from their father.
He threatened (minor) me with death.
He is engaged (versor) in writing letters.
He said that he was a general.
I am trusted (credo).
I asked (rogo) him why he did this.

(*b*) Our *forces* (omit this word) attacked the enemy while-labouring-under-the-disadvantages (impedire) of crossing (in) the river, and slew a large number of them.

(*c*) Cæsar, having at once heard of this through his scouts (speculator), dreading (voreor) an ambuscade, because he had not yet seen for what reason they were departing, kept his infantry and cavalry within the camp.

(*d*) If I had been Marius, I would have acted thus.
That pillar is sixty feet higher than the wall of the city.

(*e*) Cæsar, on his return from Britain, said that he would punish, with the utmost severity, the tribes who had rebelled against him, and refused to supply his army with corn.

Greek.

SECTION II.

Translate into Greek—

(*a*) I came (*ἔρχομαι*) from the river.
I came to the river.
I was by the river.

[N.B.—The same preposition is to be used to express from, to, and by.]

He said (*φημί*) that he was a general (*στράτηγος*).
If he had anything, he would give it.
If he had had anything, he would have given it.

(*b*) And he asked (*ἐρωτάω*) again: shall I take-a-message-of (*ἀναγγέλλω*) peace (*σπόνδαι*) or war. And Clearchus answered again *in* the same *words*—Peace, if we remain (literally to us remaining); war, if we go backwards or forwards. But he did not actually (say *διασημαίνω*) what he would do. [N.B.—Omit the words in italics when translating.]

(*c*) They fell before they conquered.

(*d*) Do not write before you learn.

(*e*) The citizen wounded the general with a sword.

Latin.

SECTION III.

Question 1. Decline conjux fidelis,—sincerum vas—and give the genders and genitive cases of auriga pelagus, imber, plebs, sanguis, cespes, dies, nurus, paries.

Question 2. Give the comparative and superlative of pauper, audax, facilis, gravis, tener, nequam, benevolus, malus, dives, senex.

Question 3. Give the perfect and supine of rapio, crepo, aperio, ferveo, peto, arcesso, retundo, comperio, sterno, fio, audeo, audio, cano, curro, vivo, vinco, vincio.

Question 4. Distinguish between vas and præs, simulo and dissimulo, agmen and acies, paries, murus and mœnia.

Question 5. Correct—perfunctum meum officium est (my duty is discharged) : humilissimus (lowest). Distinguish between—

consulere { senatum, / senatui, / in senatum. | timeo { te / tibi

Greek.

SECTION III.

Question 1. Decline *πόλις, ὄρνις, ἀιδώς*, in the singular; and *ἐπιστογή* and *βασιλεύς* in the dual and plural.

Question 2. Compare *φίγος μέγας ἡσυχος, ἡδύς, πογύς, καγὸς*, and *ἄφρων*.

Question 3. Decline throughout *σύ, ἐμαυτοῦ, εἷς*.

Question 4. Give the principal tenses in use of *βαίνω, πίνω, τέμνω, βάγγο, φημί, φέρω*.

Question 5. Distinguish between *σίγα, σίγᾷ, σῖγα—ἥ, ἦ, ἤ, ἧ*.

German.

SECTION I.

1. Translate into English :—

(*a*) Nach Tische eilte ich mir erst einen Eindruck des Ganzen zu versichern, und warf mich, ohne Begleiter, nur die Himmel gegenden merkend, ins Labyrinth der Stadt, welche obgleich van Canälen durchschnitten, durch Brücken wieder zusammenhängt. Die Enge und Gedrängtheit des Ganzen denkt man nicht, ohne es gesehen zu haben. Gewöhnlich kann man die Breite der Gasse mit aus gereckten Armen entweder ganz oder beinahe messen, in den engsten stösst man schon mit den Ellbogen an, wenn man di Hände in die Seite stemmt: es giebt wohl breitere, auch hie und da ein Plätzchen, verhaltnissmässig aber kann alles enge genannt werden. Ich fand leicht den grossen Canal und die Hauptbrücke Rialto; sie besteht aus, einem einzigen Bogen von weissem Marmor. Von oben herunter ist es eine grosse Ansicht, der Canal gesäet voll Schiffe, die alles Bedürfniss vom festen Lande herbeiführen; dazwischen wimmelt es von Gondeln.

(*b*) Beim Aufräumen fallen mir einige Eurer lieben Briefe in die Hand, und da treffe ich beim Durchlesen auf den Vorwurf dass ich mir in meinen Briefen widerspreche. Das kann ich zwar nicht merken; denn was ich geschrieben habe, schicke ich gleich fort, es ist mir aber selbst sehr wahrscheinlich, denn ich werde von ungeheuern Mächten hin und wieder geworfen, und da ist es wohl natürlich dass ich nicht immer weiss wo ich stehe,

2. Parse messen, stosst an, Schiffe, wimmelt, geworfen. giving the principal tenses of the verbs.

French.

SECTION I.

Translate into English :—

(*a*) Le ceil s'est assombri, un vent froid commence à venir du couchant; toutes les fenê res qui s'étaient ouvertes aux rayons d'un beau jour, ont été renfermées. De l'aufre côté de la rue seulement le locataire du dernier étage n'a point encore quitté son balcon. On reconnaît le militaire à sa démarche cadencée à sa moustache grise et au ruban qui orne sa boutonnière: on le devinerait à ses soins attentifs pour le petit jardin qui décor sa galérie aérienne: car il y a deux choses particulièrement aimées de tous les vieux soldats, les fleurs et les enfants. Longtemps obligés de regarder la terre comme un champ de bataille, ils semblent commencer la vie à l'âge où les autres la finissent. Les goûtes des premières années, arrêtés chez eux par les rudes devoirs de la guerre refleurissent, tout à coup, sous leurs cheveux blancs.

(*b*) Depuis le premier jour j'ai suivi les progrès de cet établissement. J'ai vu l'oiseau y transporter successivement la paille, la mousse, la laine, destinées à la construction de sa demeure, et j'ai admiré l'adresse dépensée dans ce difficile travail, Auparavant, mon voisin des toits perdait ses journées à voleter sur le peuplier du jardin, et à gazouiller le eong des gouttières. Le métier des grands seigneurs semblait le seul qui lui convînt: puis tout à coup la nécessité de préparer un abri à sa couvée a transformé notre oisif en travailleur. Il ne s'est plus donné ni repos, ni trève. Eloquent example de ce que peut la nécessité!

2. Parse s'est assombri, du couchant, on reconnaît, qui lui convînt, oisif, peut.

German.

SECTION 2.

Translate into German :—

(*a*) I was reminded of a plaything, of which I had not thought for twenty years.

(*b*) The theatres get their names from the churches to which they lie nearest.

(*c*) In a hall of the palace the judges sat.

(*d*) The gondolas do not venture out.

(*e*) We are assured that Frederick the Great is really at Catholic.

(*f*) The crab is deficient in strength.
(*g*) I could have run through the city in two hours.
(*h*) If I stayed for the summer in Rome, I should not come home before the spring.
(*i*) The days were perceptibly lengthening (zunehmen).
(*k*) Get up early to morrow.

French.

SECTION 2.

Translate into French :–

(*a*) An old maid.
(*b*) They have lived in the same room for thirty years.
(*c*) The carpenter has just been sent for to the palace.
(*d*) There is always something sad about the sunset.
(*e*) For want of air the rose-tree did not grow.
(*f*) The more anxiety (empressement) I showed, the more obstinate he became.
(*g*) The barrack was in-the-neighbourhood-of (adj.) the hospital.
(*h*) What shall we do with our poor?
(*i*) I did not think you were such an early riser.
(*k*) What do you wish me to do?

German.

SECTION 3.

1 Give the genders and plurals of Ohr, Zahn, Landsmann, Wald, Schuh, Knopf, Worf, Thräne, Bettler.

2. Give the general rules for the position of the subject in a sentence, with examples.

3. Give the diminutive terminations with their gender : give examples of anomalies arising hereunder.

7. Write out the past tense and past participles of eilen, antworten, eken, denssen, fahren.

5. Show that the silent letters in the English words, "brought, should, plough, dough, calf, eight, high, rought, weight, might," are etymologically useful as marking the relation to German.

French

SECTION 3.

1. In what cases is "lequel" used instead of "qui," and why? Give illustrations.

2. What is the usual auxiliary of the past tense in the active voice? State the exceptions and explain them.

3. Give a list of French demonstrative adjectives and pronouns, distinguishing carefully between them.

4. Explain the following phrases:—Tout à l'heure: il a épousé pas mal de fermes: une route de traverse: l'oreille au guet: j'ai salué ta venue.

5. Express in French—I have just dined. Do not sit down. Have you a headache? She got up this morning at six. I beg your pardon. You want some fresh meat. It rained last week. He was only eight years old. Here is the dining-room. London is the largest town in England.

SECOND YEAR.

MALE AND FEMALE CANDIDATES.

Languages.

Four hours allowed for this paper.

Male Candidates can answer questions in *two* Languages; *Female* candidates in *one* only.

Latin.

SECTION I.

1. Translate into English :—

(*a*) Unum petere ac deprecari: si forte pro sua clementia ac mansuetudine, quam ipsi ab aliis audirent, statuisset, Aduaticos esse conservandos, ne se armis despoliaret. Sibi omnes finitimos esse inimicos ac suæ virtuti invidere; a quibus se defendere traditis armis non possent. Sibi præstáre, si in eum casum deducterentur, quamvis fortunam a populo Romano pati, quam ab his per cruciatum interfici inter quos dominari consuessent.

(*b*) Quæ postquam vates sic ore effatus amico est,
Dona dehinc auro gravia sectoque elephanto
Imperat ad naves ferri, stipatque carinis
Ingens argentum, Dodonæosque lebetas,
Loricam consertam hamis auroque trilicem,
Et conum insignis galeæ cristasque comantes,
Arma Neoptolemi. Sunt et sua dona parenti.

2. Parse consuessent, secto, ferri, consertam, parenti.

3. Translate into English :—

Sum patriâ ex Ithacâ, comes infelicis Ulixi,
Nomen Achemenides, Trojam genitore Adamastro
Paupere (mansissetque utinam fortuna!) profectus.
Hic me, dum trepidi crudelia limina linquunt,
Immemores socii vasto Cyclopis in antro
Deseruere. Domus sanie dapibusque cruentis,
Intus opaca, ingens: ipse arduus, altaque pulsat
Sidera (Di, talem terris avertite pestem!)
Nec visu facilis, nec dictu affabilis ulli.
Visceribus miserorum et sanguine vescitur atro.

Greek.

SECTION I.

1. Translate into English :—

(*a*) Αὐτὰι δὲ αἱ βάλανοι τῶν φοινίκων, οἵας μὲν ἐν τοῖς Ἕλλησι ἔστιν ἰδεῖν, τοῖς οἰκέταις ἀπέκειντο· αἱ δὲ τοῖς δεσπόταις ἀποκείμεναι ἦσαν ἀπόλεκτοι, θαυμάσιαι τὸ κάλλος καὶ τὸ μέγεθος· ἡ δέ ὄψις ἡλέκτρου οὐδὲν διέφερεν· τὰς δέ τινας καὶ ξηραίνοντες τραγήματα ἀπετίθεσαν. Καὶ ἦν καὶ παρὰ πότον ἡδὺ μὲν κεφαλαλγές δέ.

(*b*) χόρευσε δ' ἀμφὶ σὰν κιθάραν,
Φοῖβε, ποικιλόθριξ
νεβρὸς ὑψικόμων πέραν
χαίρουσ' εὐφρονι μολπᾷ.

(*c*) πρὸς τῶν ἐχόντων, Φοῖβε, τὸν μόμον τίθης.

(*d*) δμαθέντας γὰρ ἀνίστη.

(*e*) ἢ τέμω τρίχα;

(*f*) οἵας ἡμπλακες ξυναόρου.

2. Parse ἀπετίθεσαν, σὰν, ἐλατᾶν, προϊέναι, συμμίξειαν, φαίη καθίσειν, ἀπιοῦσι, ἐλόμενοι, θέμενοι, ἐλούσατο, ἐκταθήσεται, ἀμπετάσας, ᾗδε, μεθορμεῖ, συθεὶς, ἐξελᾷ κατερρύγασιν.

3. Translate into English :—

Αλλ' ἥδομαι μὲν, ὦ, Κλέαρχε. ἀκούων σον φρονίμους λόγους· ταῦτα γὰρ γεγνώσκων, εἴ τι ἐμοὶ κακὸν βουλεύοις, ἅμα ἂν μοι δοκεῖς καὶ σαυτῷ κακόνους εἶναι. Ὡς δ' ἂν μάθῃς, ὅτι οὐδ' ἂν ὑμεῖς δικαίως οὔτε βασιλεῖ οὔτ' ἐμοὶ ἀπιστοίητε, ἀντάκουσον. Εἰ γὰρ ὑμᾶς ἐβουλόμεθα ἀπολέσαι, πότερα, σοι δοκοῦμεν ἱππέων πλήθους ἀπορεῖν, ἢ πεζῶν, ἢ ὁπλίσεως, ἐν ᾗ ὑμᾶς μὲν βλάπτειν ἱκανοὶ εἴημεν ἄν, ἀντὶ πάσχειν δὲ οὐδεὶς κίνδυνος;

Latin.

SECTION II.

Translate into Latin :—

(*a*) He promised to give me a book.
The soldiers kept-on-asking their general for money.
Cæsar said that if I wrote (scribo) he would answer (respondeo).
It does not matter (interest) to me whether he be alive or dead.

(*b*) He showed *them* (historic present) how important it was (intersum) for the state and the general safety that the forces of the enemy should-be-kept-apart (distineo), so that they might not be-obliged-to-fight (confligere) with so large a number at one time.
Cæsar, when he heard that the Helvetii had conveyed a large part of their forces across the river, resolved to attack the remainder, still encumbered with baggage, and not expecting his arrival.

(*d*) As he could not punish the Germans, who had taken refuge in the dense forests on the other side of the Rhine, Cæsar ordered a bridge to be immediately built over that wide, deep, and rapid river.

Greek.

SECTION II.

Translate into Greek :—

(*a*) And when they had-taken-their-stand (ἵστημι) within hearing distance (ἐπήκοος) Ariæus spoke these *words*: "Clearchus, O Greeks, has his just punishment (δίκη) and is dead-t for he was-found-to-be (φαίνω) a perjurer (participle) and a breaker-of treaties: but Proxenus and Meno are *held* in high honour because they reported (καταγγέλλω) his treachery. And

from you the king demands back your arms; for, he says, they are his, since they were those of Cyrus, his servant."

[N.B.—Omit the words in italics when translating.]

(*b*) Cyrus, having crossed the river, advanced two days' march, ten parasangs, to a large and wealthy city, where he remained six days.

(*c*) Death is common to the worst and to the best men.

(*d*) My father has given me the book which you gave him.

(*e*) Wise men learn many things from enemies.

(*f*) That is not the part either of a wise or a good man.

Latin.

SECTION III.

Question 1.—Give the perfect indicative and present infinitive of nolo, eo, fero, cædo, occido, cado, quæro, obliviscor, comminiscor, possum, prosum.

Question 2.—Give the genitive singular and dative plural of—caro, dos, mus, vellus, locus, palus, vulgus, civis, cinis, ŏs, and ōs. Name, in each case, the gender.

Question 3.—After what sort of verbs are quin and quominus used? Give examples.

Question 4.—When does quum take the subjunctive after it, and when the indicative? Mention any exceptions to the general rule.

Question 5.—What cases of the person and thing follow—damnare, circumdare, docere, adimere?

Greek.

SECTION III.

Question 1.—Give the first person singular of all the tenses of the indicative mood of ἵστημι and their meaning in English.

Question 2.—Give the first person singular of the future and second aorist indicative of the following verbs—λαμβάνω, λανθάνω, τυγχάνω, πυνθάνομαι, ἁλίσκομαι, γεγώσκω, εὑρίσκω, ἀποθνήσκω, πάσχω, γίγνομαι, ἔχω, δίδωμι.

Question 3.—With what moods and tenses is μὴ used in prohibitions? What is the difference in meaning?

Question 4.—Translate and explain the construction of—

οὐ μὴ ποιήσεις,

οὐ μὴ ποιήσῃς,

οὔτ' ἂν δυναίμην μήτ' ἐπίσταίμην λέγειν (ἐπίσταμαι=I know).

Question 5.—With what words in other languages are these etymologically connected? κύων, ὄγη, τως, οἶνος, ἔαρ, ἔπομαι.

German.

SECTION I.

1. Translate into English :—

(*a*) Und lasst mich nun auch sagen, dass ich tausendmal, ja beständig Eurer gedenke, in der Nähe der Gegenstände, die ich allein zu sehen niemals glaubte. Nur da ich jedermann mit Leib und Seele in Norden gefesselt, alle Aumuthung nach diesen Gegenden verschwunden sah, konnte ich mich entschliessen einen langen einsamen Weg zu machen, und den Mittelpunkt zu suchen, nach dem mich ein unwiderstehliches Bedürfniss hinzog. Ja die letzten Jahre wurde es eine Art von Krankheit, von der mich nur der Aublick und die Gegenwart heilen konnte.

(*b*) Wall.—Es ist zu spät: du weisst nicht was geschehn.

Max.—Und wär's zu spät—und wär' es auch so weit,
Dass ein Verbrechen nur vom Fall dich rettet,
So falle! falle würdig, wie du standst.
Verliere das Commando. Geh' vom Schauplatz.
Du kannst's mit Glanze, thu's mit Unschuld auch.
—Du hast für andre viel gelebt, leb' endlich
Einmal dir selber! Ich begleite dich,
Mein Schicksal trenn' ich nimmer von dem deinen—

Wall.—Es ist zu spät. Indem du deine Worte
Verlierst, ist schon ein Meilenzeiger nach dem andern
Zurückgelegt von meinen Eilenden,
Die mein Gebot nach Prag und Eger tragen.
—Ergib dich drein, wir handeln wie wir müssen.
So lass uns das Nothwendige mit Würde,
Mit festem Schritte thun—Was thu' ich Schlimmres
Als jener Cäsar that, dess Name noch
Bis heut das Höchste in der Welt benennet?
Er führte wider Rom die Legionen,
Die Rom ihm zur Beschützung anvertraut.
Warf er das Schwert von sich, er war verloren,
Wie ich es wär', wenn ich entwaffnete.
Ich spüre was in mir von seinem Geist,
Gib mir sein Glück! Das Andra will ich tragen.

2. Parse: Eurer — jedermann — Jahre—was geschehn—schlimmres—dess Name—warf.

French.

SECTION I.

1. Translate into English :—

Il en est des destinées comme des aurores: les unes se lèvent rayonnantes de mille lueurs, les autres noyées dans de sombres nuages. Celle de l'oncle Maurice fut de ces dernières. Il vint au monde si chétif qu'on le crut condamné à mourir: mais, malgré ces prévisions, que l'on pouvait appeler des espérances, il continua à vivre souffrant et contrefait. Son enfance, dépourvue de toutes les grâces, le fut également de toutes les joies. Opprimé à cause de sa faiblesse, raillé pour sa laideur, le petit bossu ouvrit en vain ses bras au monde le monde passa en le montrant au doigt. Cependant sa mère lui restait, et ce fut à elle que l'enfant reporta les élans d'un cœur repoussée. Heureux dans ce refuge, il atteignit l'âge où l'homme prend place dans la vie, et dut se contenter de celle qu'avaient dedaigné les autres. Son instruction eût pu lui ouvrir toutes les carrières: il devint buraliste d'une des petites maisons d'octroi qui gardaient l'entrés de sa ville natale!

2. Parse—le fut—atteignit—eût pu lui ouvrir. Comment on the following phrases—ce fut à elle que—qu'avaient dédaigné les autres.

3. Translate into English :—

(*a*) Un prêtre, environné d'une foule cruelle,
Portera sur ma fille une main criminelle,
Déchirera son sein, et d'un œil curieux,
Dans son cœur palpitant consultera les dieux!
Et moi, qui l'amenai triomphante, adorée,
Je m'en retournerai seule et désespérée!
Je verrai les chemins encore tout parfumés,
Des fleurs dont sous ses pas on les avait semés!
Non, je ne l'aurai point amenée au supplice,
Ou vous ferez aux Grecs un double sacrifice!
Ni crainte ni respect ne m'en peut détacher.
De mes bras tout sanglants il faudra l'arracher.
Aussi barbare époux qu'impitoyable père,
Venez si vous l'osez la ravir à sa mère.
Et vous, rentrez, ma fille, et du moins à mes losi
Obéissez encore pour la dernière fois.

Or (*b*) C'en est fait: je n'en puis plus, je me meurs, je suis mort, je suis enterré. N'y a-t-il personne qui veuille me resusciter, en me rendant mon cher argent, ou en m'apprenant qui l'a pris? Hé! que dites vous? Ce n'est personne. Il faut, qui que ce soit qui ait fait le coup, qu'avec beaucoup de soin ou ait épié l'heure: et l'on a choisi justement te temps que je parlais à mon traître de fils! Je veux aller quérir la justice, et faire donner la question à toute ma maison, à servantes, à valets, à fils, à fille, et à moi aussi. Que de gens assemblés! Je ne jette mes regards sur personne qui ne me donne des soupçons, et tout me semble mon voleur. Hé! de quoi est-ce on parle là? de celui qui m'a dérobé? Quel bruit fait on là-haut? est ce mon voleur qui y est? De grâce, si l'on sait des nouvelles de mon voleur, je supplie que l'on m'en dise.

German.

SECTION II.

Translate into German :—

This race-of-men did not take refuge in these islands for (zu) amusement: it was no caprice which drove the next comers (Folgende) to unite with them; necessity taught them to seek their safety in the most disadvantageous situation, and made them shrewd (klug) when the whole northern world still lay enslaved in gloom: their multiplication and wealth were a necessary result. Now their dwellings began-to-press (reflective) higher and higher: sand and marsh were replaced by rocks. The houses were forced to seek to gain in height what they lacked in breadth. Grudging (literally, niggardly-of) every span of soil, they allowed for streets no greater breadth than was needful to separate one row of houses from that standing opposite, and to keep scanty gangways for the citizens.

French.

SECTION II.

1. Translate into French :—

The carpenter looked at his wife and son with an air of stupefaction (adj.): it was necessary to proceed (en venir) to explanations. The latter related how he had entered into negociations with Benoit, who as-the-price-of (pour) handing-over his business, had absolutely insisted on half the two thousand

francs down. It was in the hope of procuring this that he had taken-on (entrer) at a master contractor's at Versailles; there he had been able to experiment on his invention, and to find a purchaser. Thanks to the money received, he had just closed with Benoit; and he was bringing his father the key of the new workshop. This explanation of the young workman had been given with so much modesty and simplicity, that I was quite affected thereby.

German.

SECTION III.

1. How are separable and inseparable compound verbs distinguished? Give five instances, with the meanings attached.
2. Give a concise sketch of the character of Wallenstein as brought out in 'Wallenstein's Tod.'
3. Express in German: The longer the better. Go on writing. There is too much talking in Parliament. Get your coat mended. He died on his journey home. I like sweet wine. Christians must not hate one another. There are men who cannot bear (leiden) travelling. Three times twelve are thirty-six.

French.

SECTION III.

1. Give a rule for distinguishing between the present participle and the participial adjective; state, and illustrate by example, the difference of grammatical usage in the two cases.
2. 'Il marchait jusqu'à ce que la faim et la fatigue se fissent sentir:' explain the use of the substantive.
'La fièvre a été noyée absolument comme Poniatowski dans l'Elster.' Explain the allusion, and show its appropriateness.
'On regardait chez moi par les fentes, et l'on me calomniait.' Translate and explain. How is the metaphor contained in the word 'fentes' carried on by the speaker in the next line?
5. Express in French:—The girl to whom I lent the book has not returned it—It is you I am speaking to—The patient is going on better since we changed the medicine—He lived in a family by whom he was dearly loved—Be so-good-as to hold your tongue—I have had a fine bed-room built—A month ago she had not even seen him—As I passed the post, I asked for letters—The more you eat of it, the fatter you get (engraisser)—The old woman and her grandsons lost their way on the road to Paris.

FIRST YEAR.

FEMALE CANDIDATES.

Grammar and Composition.

Three hours allowed for this Paper.

Every Candidate *must* perform the exercise in Composition,

Composition.

Write a brief essay on *one* of the following subjects—
1. The four seasons of the year.
2. Rewards and punishments for children.
3. The characteristics of a good schoolmistress.

Grammar and Composition.

Lines on hearing a Thrush sing in a morning walk in January.

Sing on, sweet thrush, upon the leafless *bough*,
Sing on, sweet bird; I listen to thy *strain*;
See, aged *Winter*, 'mid his surly reign,
At thy blithe carol clears his *furrowed* brow.

So in lone Poverty's dominion drear,
Sits meek Content, with light, unanxious heart,
Welcomes the rapid moments, *bids* them part,
Nor asks *if* they bring aught to hope or *fear*.

I thank Thee, Author of this opening day,
Thou *whose* bright sun now gilds the orient skies!
Riches denied, Thy boon was purer *joys*,
What Wealth could never give nor *take* away.

BURNS.

1. Express in simple prose the above passage.
2. Analyse the passage, and parse the words in italics.
3. Make a list of the words which are not of Anglo-Saxon origin in the above passage, and give their derivations.
4. What information can you give about the author?

TO THE RAINBOW.

Triumphal arch, *that* fill'st the sky
When storms prepare to part,
I ask not proud Philosophy
To teach me *what* thou art.

Still *seem*, *as* in my childhood's sight,
A midway *station* given
For happy spirits to alight
Betwixt the earth and heaven.

Can all that optics teach, *unfold*
Thy form to please me *so*
As when I dreamt of gems and gold
Hid in thy radiant bow?

When Science from creation's face
Enchantment's *veil* withdraws,
What lovely visions yield their place
To cold material laws!—CAMPBELL.

1. Express in simple prose the above passage.
2. Parse the words in italics, and Analyse the first and third and fourth stanzas.
3. Give examples from the above, of— (*a*) personification, (*b*) antithesis, (*c*) inverted order.
4. What information can you give about the Author?

KING HENRY V.

So work the honey bees;
Creatures, that by a rule in nature *teach*
The act of order to a *peopled* kingdom.
They have a king and officers of sorts:
Where some, like magistrates, *correct* at home:
Others, like merchants, venture *trade* abroad:
Others, like *soldiers*, armèd in their stings,
Make boot upon the summer's velvet buds,
Which pillage they with merry march bring home
To the tent royal of their emperor;
Who, busied in his majesty, surveys
The singing masons building *roofs* of gold.
The civil *citizens* kneeding up the honey,
The poor mechanic porters *crowding in*
Their heavy burdens at his narrow gate.

SHAKSPERE.

1. Express in simple prose the above passage.
2. Parse the words in italics, and analyse the passage from "*They have a king*" down to "*roofs of gold.*"
3. Show what expressions in the above belong to an earlier date in our literature than the present.
4. What information can you give about the Author?

School Management.

Three hours allowed for this Paper.

No Candidate is permitted to answer more than *eight* questions. All who answer a sufficient number of questions for Infants, viz., those marked with an asterisk (*),—satisfactorily, *and who afterwards pass a satisfactory probation in Infant Schools*, will have a *special stamp* added to their Certificates when issued. Candidates for the special stamp for Infants *must* write "*for Infants*" at the heading of this paper.

N.B.—Question No. 1 (on Registers) MUST be answered by all Students who are proceeding to a school, and BY ALL ACTING TEACHERS, but should be omitted by Students who are remaining in the Training College for another year.

1. Distinguish between the average attendance of a school or class, and the average number of attendances made by each child, and show how each is found.

Give a specimen of a Class Attendance Register with ten names for one week, and show how the following particulars should be marked and calculated:—
(*a*) Presence and absence;
(*b*) School holiday;
(*c*) Leaving school before the expiration of two hours' secular instruction;
(*d*) Correction of previous mark;
(*e*) Percentage of absence for the week;
(*f*) Number of attendances;
(*g*) Average attendance.

2. Show how you would appropriate the school hours of one week to the several subjects of instruction in—

*(*a*) An Infant School composed wholly of children under 7; *or*,

(*b*) An Infant School including a First Standard; *or*,

(*c*) A Girls' School.

Are there any lessons or exercises which should be placed earlier in the day than others? Give reasons for your answer.

*3. In teaching very young children to read, is it better to begin with the alphabet or little words? Give your reasons.

4. Sketch the outline of a lesson on *one* of these subjects:—

(*a*) Gibraltar;

(*b*) Silver and its uses;

(*c*) Wheat;

*(*d*) A kitchen (*for an Infant class*).

*5. Give some examples of the sort of oral or mental exercise in Arithmetic suited for a class of beginners. Say what other visible illustrations, besides the ball-frame, would be useful in teaching to count.

6. What are the advantages and disadvantages of engraved head lines in copy books? When and how would you think it necessary to supplement them, by setting copies on the blackboard? Arrange the letters of the alphabet in the order of their difficulty, and show how you would group them together in your earliest writing lessons.

7. Give some rules for conducting a good dictation lesson, and for correcting the exercise expeditiously and thoroughly.

8. If you are called on as head teacher to select sets of reading books for Standards I. and II., how will you be guided in your selection, and what conditions ought such books to fulfil?

*9. What are the best means to be employed in order to make your scholars' reading expressive and intelligent? How far are *pattern-reading*, *simultaneous reading*, and *recitation*, respectively, likely to be useful to this end?

*10. Give a list of the object lessons which should be given in the course of three months to children of the First Standard. What is the general purpose which such lessons ought to serve, and what is the advantage of making such a list beforehand?

11. In what way can a plan of the school and its immediate surroundings serve as an elementary lesson on Geography? Draw such a plan, of any schoolroom you know; and show how it might be made useful in giving to children right notions of dimension and of distance.

*12. In what ways may a good teacher hope to influence the habits and the moral character of the children under her care? Refer especially to any means at her command for inculcating (1) Respect for parents, (2) The love of truth.

13. If a Penny Savings' Bank were attached to your school, in what way do you think you could properly promote its success; and by what other means could you encourage the habit of thrift among your scholars?

British History.

Three hours allowed for this Paper.

No Candidate is permitted to answer more than *eight* questions.

1. Describe the steps by which William the Conqueror established his dominion in England.

2. Give some account of the circumstances which brought England and Scotland in contact during the reign of Stephen.

3. In whose reigns did the Crusades occur? Give a summary of events in England during the third crusade.

4. What were the occasions and grounds of dispute during the reign of Henry III. between (*a*) England and Wales, (*b*) England and Scotland, (*c*) England and France? What were the results?

5. Describe the relations that existed between Edward II. and the Barons, and state fully the course and consequences of the second revolt.

6. Give an account of the campaign in which the Battle of Poitiers was fought, with dates; and state the political results that followed.

7. Who were the Lollards? In what reigns do we hear most about them? Give their origin, some of their chief doctrines, and the reception they met with.

8. What circumstances gave importance to the Battles of Homildon Hill and Shrewsbury in the reign of Henry IV.?

9. On the accession of Henry VI., what arrangements were made for the government of the kingdom? State briefly the part taken by the principal officers, and the result at the close of the French War.

10. What steps were taken by the English Sovereigns to incorporate Ireland into their dominions?

11. State the obstacles to his throne encountered by Henry VII., and how far he overcame them.

12. What progress did the Reformation make in the reign of Henry VIII.?

13. Explain the claim of Lady Jane Grey to the Throne of England, the manner in which it was promoted, and the results to those engaged in forwarding it.

14. Mention the most celebrated of the English Navigators, and give some account of their voyages.

15. Give a sketch of the social condition of England during the Tudor Period.

Geography.

Three hours allowed for this Paper.

No Candidate is permitted to answer more than *eight* questions; or draw more than one map, in addition to the *diagram* (Question 2).

1. Give the proofs of the earth's roundness most likely to be intelligible to children in Standard II., and illustrate them very clearly.

2. Explain the meaning of the terms:—Zone, Meridian, Equator, Parallel of Latitude: illustrating your explanations by a diagram.

3. What explanations would you give to a child who asked you the cause (*a*) of the drops of water on the inside of the cover of a dish of hot potatoes; (*b*) of the moisture on a window-pane in cold weather; (*c*) of the similarity between the steam from an engine and the clouds; and (*d*) why all the water in a saucepan disappears if the latter be left too long on the fire?

4. Assign the following animals and plants to their proper zones:—

Hippopotamus, Giraffe, Buffalo, Beaver, White Bear, Wolf, Reindeer; Cinnamon, Date Palm, Indigo, Olive, Strawberry.

5. Name, in their order from north to south, the chief capes, islands, towns, and openings, with the rivers (if any), flowing into them,—on the west coast of Ireland.

6. Name the chief agricultural and other products of Ireland. State from what ports in that country, to what ports in England, respectively, they are sent.

7. Where are the Highlands of Scotland said to begin? Name the three largest Highland and the three largest Lowland Counties. Compare the physical features, population, and productions of the Highlands with those of the Lowlands.

8. Describe briefly a voyage along the east of Scotland from Fife Ness to Tarbet Ness, mentioning anything of interest that you know respecting the places you would pass.

9. What is a coal-field? Describe that situated in Staffordshire, with its chief industries and their centres.

10. Name, in the order of size, the principal seaports in the United Kingdom, their situations, and their chief objects of trade, respectively.

11. In what parts of the British Isles are the following articles chiefly produced:—Cider, hops, cheese, hams, soda, boots and shoes, gloves, ribbons, woollen cloth, straw hats, shawls, linen, lace?

12. What and where are Barra, Pomona, Bandon, Valentia, Glendalough, Exmoor, Taunton, Portrush, Ulleswater, Saddleback, Ingleborough, McGillicuddy's Reeks, the Minch, the Solent, the Wash, the Naze, the Nore, the Lizard, the Eddystone?

13. Draw a map of the coast from the Land's End to Holyhead; or from Spurn-head to the South Foreland.

14. Draw a map of the coast-line of Scotland from Cape Wrath to Kinnaird Head; *or*, from the latter to the Port of Leith—marking, in each case, the river-mouths and names of counties.

15. Draw a map of the South Coast of Ireland between Carnsore Point and Cape Clear, giving the chief openings and seaports.

Arithmetic.

Two hours and a half allowed for this Paper.

No Candidate is permitted to answer more than *ten* questions.

The solution must be given at such length as to be intelligible to the Examiner, otherwise the answer will be considered of no value.

1. Add together one hundred and seven thousand and eleven, ten thousand one hundred and six, five hundred and ninety thousand and twenty, two hundred and fifty-nine thousand seven hundred and seven;—Multiply the sum of those numbers by three hundred and ninety-eight and divide the product by seven hundred and twenty-six. Give the sum, product, and quotient in words as well as in figures.

2. Take 8 acres, 3 roods, 17 poles, 3¼ yards, from ten acres, and multiply the remainder by 85.

3. Make out the following bill:—29½ yards of flahnel, at 3s. 4½d. per yard, 37 yards of calico, at 5½d. per yard, 112 yards of calico, at 6¼d. per yard, 29 yards of cloth, at 1s. 4½d. per yard, 17½ dozen pairs of socks, at 18s. 6d. per dozen—Deduct 2d. in the shilling for discount, and receipt the bill.

4. Find by practice the value of 1,704 articles at £7 18s. 6¾d. each. *Or*, the cost of 69 cwt., 1 qr., 21 lbs., at £3 17s. 8d. per cwt.

5. A bankrupt's debts amount to £5,856, but his assets are sufficient to pay 18s. 11½d. in the £. What will be lost by a creditor to whom one quarter of the bankrupt's debts are owing?

6. If the charge for digging a pit 30 feet long, 18 feet 6 inches wide, and 8 feet 9 inches deep be £50 10s., how much more would it cost to make it 5 feet longer and 9 inches deeper?

7. I walked a tour of 377·0139375 miles at a uniform rate of 4·3075 miles per hour. How many hours did my journey take?

8. Find the value of £3,808 3s. 3¾d. × (1¼ of 8¾ ÷ 1⅛ of ⅜).

9. At a concert $\frac{1}{16}$ of the audience paid 10s. each for their seats, ⅛ paid 5s., $\frac{1}{12}$ paid 2s. 6d., ⅔ paid 1s., ¼ paid 6d., and the remaining 38 were let in free. How many attended the concert and what amount of money was taken?

10. In what time will £989 10s. amount to £1,189 13s. 3¾d., at 4½ per cent. per annum, simple interest?

11. A man buys a farm of 150 acres for £4,624, and after repairing the buildings, etc., lets it at 30s. per acre, thereby getting a return of 4½ per cent. for his money. What sum did he spend in repairs.

12. A dealer lost a sum equivalent to 9⅓ per cent. on the sale of goods which cost him £3 9s. 2d., but gained a sum equal to 9⅓ per cent. on a lot which cost him £7 10s. How much per cent. had he gained or lost at the end of both transactions?

13. Explain, as you would to children, and illustrate by examples, what is meant by (*a*) *A Decimal*, (*b*) *A Factor*, (*c*) *Percentage*, (*d*) *Discount*, (*e*) *The rule of Three by "the method of unity"* or *"first principles."*

Domestic Economy.

Three hours allowed for this Paper.

No Candidate is permitted to answer more than *eight* questions.

1. Into what classes may foodstuffs be divided? Give examples of each.

2. How may pure freshly-ground flour be known? Explain why bread made from the whole meal is more nutritious than white bread.

3. In what way may dripping be used as a substitute for butter in the families of the poor?

4. Give directions to a first class for setting in a patch, stating your reasons for each step in the process.

5. What are the relative advantages of wool, cotton, and linen for clothing (*a*) with regard to health; (*b*) with regard to cost?

6. How should a child's frock be cut out? Illustrate your answer by diagrams, and state the quantity of material required for a child eight years old.

7. Give receipts for a meat pudding, a light pudding for invalids, and a meat soup.

8. What are the preparations that should be made for washing day? In what order should the clothes be washed, and state why some should be boiled and some not.

9. Describe any machines you may be acquainted with for lessening the labour in washing; their advantages, and the objections sometimes made to them.

10. What is starch? How is it manufactured, and how prepared for use?

11. Write notes for a first class on clothing.

12. Describe generally, as to a Fourth Standard, the processes by which *one* of the following is prepared for clothing: skins of animals, cotton, flax, silk in the cocoon.

(To be continued.)

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Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

II.

I AM frequently consulted as to the duty of the principal of a boarding-school when infectious disease has suddenly appeared among the boarders. To my mind, the duty is clear. The principal should immediately find out which of the children have been recently in contact with the case by sleeping in the same dormitory, or by being in the same class, or in any way in close contact with the sick child. Then find out who among this number have not previously had the disease in question. Put all these in quarantine immediately. Inform the parents of the affected child that the child is ill, and as soon as may be convenient he should give information to the parents or guardians of all the children that such a case has appeared in the school, and that the manager has taken the necessary precautions to prevent the extension of the disease. It is a great mistake to keep this fact a secret from those most interested, and if the parents are made aware of the rule of the school when a child is first sent to it, they will be much more content and less suspicious than if they are kept in ignorance of the outbreak, whilst a serious responsibility is removed from the shoulders of the principal or manager, which responsibility he has no right to assume. If the cause for the introduction of the case can be proved to be by means of personal contact, the spread of the disease may be checked at once. If this is not a doubtful point it follows that in all probability there will be no extension beyond that which arises from the danger which those in quarantine may have fallen into. The quarantine must be kept up as long as may be necessary to clear the children from the suspicion of having contracted the disease. If the cause of the outbreak is in the school itself it must be removed, but to do this it becomes necessary to find out from where the cause proceeds. If cases continue to occur in a school in which the course above recommended has been adopted, there is always reason to suppose it may have a local origin. It will be only right to consult an expert as to its possible cause, and especially to into communication with the Medical Officer of Health of the district in which the school is situated. Indeed, it is always right to inform this official of the outbreak immediately it arises, and to take his advice upon it. It is certain that in the course of a short time this course will become a compulsory duty, and its neglect will involve severe penalties; and as such is sooner or later likely to be the law of the land, it will be best to get into the way of it, and do that from choice which will soon be one of necessity. There is no plan which will be more conducive to the interest of the schoolmaster than this action of the legislature. It will enable the master to know from whence the disease has been imported into his household, and to trace it backwards to its source, and by that means give him a just ground for complaint against the author of his misfortune, if it has had an origin from without. I press this side of the question very forcibly upon all who have infectious disease introduced among them; it will be of greater benefit to school managers and school proprietors than to any other class of persons, especially if the case is one of scarlet-fever or small-pox, for these cases do not crop up unless there has been contact with a preceding case of disease; they do not suddenly put in an appearance without connection with some preceding case, and isolation must be immediate to prevent further mischief. This isolation may be carried out by removing the patient to the top of the house and entirely shutting off immediate communication with the rest of the establishment, or, better still, by removing the child to a separate cottage, where there can be the most perfect quarantine. The greatest danger of infection from these cases is during the fever stage, when it is probable that the exhalations from the patients are themselves infectious and incapable of being disinfected with that certainty which can be carried out with the later debris, which is particulate in its character, and is usually wrapped up in some epithelial particles. It is necessary to freely disinfect the excreta which come from the patients immediately upon discharge. This is easily effected by receiving them into a vessel containing a strong solution of Persulphate of Iron (green copperas an ounce to the gallon), or into a bed of dried earth, such as an ordinary earth-closet supplies. It is not difficult to prevent the spread of infection during the convalescent stage, because the breath then ceases

in a great measure to be infectious, and our efforts may be directed to the disinfection of the debris and of the articles of clothing which have been worn by the patients as well as of the bedding which has been used. These may be completely purified by exposing them to a dry heat of 330°, or by plunging them into boiling water.

A scarlet-fever patient should have the body anointed daily with pure salad oil in which camphor has been dissolved in the proportion of one dram in two ounces of oil. If the case is one of small-pox it is better to use animal charcoal finely produced instead of camphor. If mixed in such proportions as will make a thin paste, and applied to the patches of eruption, it will prevent the pitting, and probably also prevent the fertility of the germs contained in the secretion of the pox, for I think it is now established on a perfectly sound foundation that these diseases are propagated by the dispersion of minute atoms of perverted protoplasm, which retain their vitality, and are capable of germinating in suitable soil so as to reproduce their kind. These vital germs are allied in character to the fungi on the one side and the algee on the other, and they require for their propagation some of the conditions which belong to both; light and ozone are antagonistic to their reproduction, and with free motion of the atmosphere, are the agents which are antagonistic to the maintenance of their vitality, and it is upon these agents that the principle of repression or stamping out infectious disease depends. Introduce light into the places which have been occupied by fever patients of any kind, ventilate freely with atmospheric air, and supply ozone as abundantly as possible, and it is quite certain that in a short time there need be no danger of the spread of infectious diseases among children or any other classes of persons.

Typhoid fever is much more amenable to repressive measures than either of the two former diseases. It is scarcely infective at all, except under very exceptional conditions. It is sometimes called enteric, sometimes gastric, low or continued fever. It is more often caused by a water supply contaminated by sewage than by any other means. Whenever a case arises in any school it is incumbent upon the managers to look to their source of supply, and inquire narrowly into the possibility of contamination from some one of the many causes which will now and then crop up in the best regulated establishment. Recurring cases must be traceable either to water or milk, or some other article of food, or to a want of sewer ventilation. It is due to these causes more certainly than to personal communication. In any case consult the medical officer of the district. Immediately disinfect the excreta of the patient. In all cases of infective disease remove all curtains, carpets, and every kind of cloth from the room which is occupied by the patient, for those articles absorb the *materies morbi*, and may give out again to somebody else, and the most perfect cleanliness of all persons who come in contact with the sick must be insisted upon. Daily fumigation of the sick room and of the house in which infectious disease exists should be carried out by burning some brown paper or woody matter and sprinkling carbolic acid with water in the form of spray. A very elegant way of fumigation, and a very efficient means for removing smell, is by burning some ground coffee upon live embers taken from a fire, and held in the middle of the room upon an ordinary shovel—a few spoonfuls of coffee burnt in this manner give a very agreeable odour, and effectually remove all disagreeable smell in a very few minutes. There is one other important matter which it is well to notice. No attendant upon a sick person should ever take food in the sick person's room. It is running a risk, which it is the duty of the principal to prevent by providing that the nurse shall have a room for feeding in, which shall not be the one occupied by the patient. I must refer my readers to the chapters in the first volume of the PRACTICAL TEACHER on 'Health at School' for further information upon points more immediately connected with personal hygiene.

ON WOUNDS.

There are many dangers which naturally belong to school-boys, and which, if attended to at once, are not likely to lead to mischief, but which if neglected may lay the foundation for constitutional diseases, and often lead to the loss of limb, or even to life itself.

It is very common for children to bark themselves, as it were, in running, or in any kind of boisterous game; they fall down upon a gravel path or other rough ground, and produce simple abrasions of the skin, or a contused wound may be produced, or the cut may go deeper, and be really incised. In abrasions there is simply the removal of the cuticle; contusions have bruises which extend to a deeper part of the cutis, whilst in incised wounds these cuts are more or less deep, and more or less clean. Lacerated wounds are those in which the parts are more or less torn, and these, with the class of punctured wounds, are by far the most dangerous; and lastly, there is another dangerous kind consisting of poisoned wounds, which require to be considered each in detail.

(1) *Abrasions.* These require to be cleared from the dirt and gravel which they may contain, and they should then be preserved from contact with the external air as quickly as possible. The simplest way to treat these cases is to cover them up with a slip of lint soaked in Friar's balsam, or Compound Tincture of Benzoin, as it is styled in the 'Pharmacopedia.' The application produces a slight smarting, which soon goes off, and if the child's blood is in a moderately healthy state, it will heal rapidly. It is not well to bind up too lightly; only apply the lint so that it may be kept in situ.

(2) *Contused Wounds.* The same treatment is all that is required; it is not necessary to stay until all bleeding has ceased, but as soon as the place is properly cleansed, put on the Frair's balsam, and cover it up from the atmosphere, and allow the dressing to remain on for some days, unless the place should become hot and painful, in which case a poultice should be applied to soften the dressing, and the rules of treatment somewhat altered, as will be described in considering lacerated wounds.

(3) *Incised Wounds.* The treatment will depend very much upon their extent. The old custom of sewing up cuts of this kind is best when let alone, and not followed. There is seldom any requirement for such an operation. The wounds are frequently accompanied by serious hæmorrhages consequent upon an injury to an artery or a vein. The injury to an artery is a very serious contingency, and the services of a surgeon should be obtained as rapidly as possible. In the mean-

time the hæmorrhage must be arrested, by pressure applied in the right manner. Hæmorrhage from a vein is at once stayed by the gentlest pressure; the blood is dark in colour, and flows in a continuous stream. Not so that from an artery; it comes out of the wound in jets, which correspond with the pulse, and has a bright scarlet colour. Hæmorrhage from a vein is easily restrained by the finger pressing gently on the wounded part; or if it be a large vein by a firm pressure or ligature applied below the wound; if the cut is upon one of the limbs it generally ceases in a very short time. The bleeding from an artery is continuous in spite of gentle pressure, and can only be stayed by a ligature tightly pressed upon the artery which supplies the limb, which must be applied above the wound between the latter and the heart. Suppose it is the artery in the wrist which is cut, the ligature must be applied tightly above the wound between it and the elbow, but if it is the vein, then gentle pressure upon the cut will be sufficient to arrest all flow in a few minutes. Sometimes it is necessary to make very steady and strong pressure upon a bleeding artery. This can be effected by tying a handkerchief tightly around the limb, using a cork as a means for obtaining due pressure directly upon the artery, and increasing the pressure by a stick which is inserted between the handkerchief and the limb on the opposite side to the wound, and twisted round so as to completely stay circulation through the artery, and which should be kept up until the surgeon arrives.

(To be continued.)

Eminent Practical Teachers.

PESTALOZZI.

BY THE REV. CANON WARBURTON, M.A.,
Her Majesty's Inspector of Training Colleges for Schoolmistresses.

II.

FROM the breaking up of the establishment at Neuhof in 1780, eighteen years elapsed before Pestalozzi again attempted to keep a school.

His existence during that period was depressed, poverty-stricken, and at times almost precarious; but it afforded him plenty of leisure for thinking out and maturing his ideas, and making them known to the world by his writings. He was the author of several works, but of these three only need be remembered, for it was by them that his reputation was gradually established, and Pestalozzi came to be recognised as the foremost educational thinker and reformer of his time. The names of these works are (1) 'The Evening Hours of a Hermit,' (2) 'Leonard and Gertrude,' and (3) 'How Gertrude Teaches her Children.' The last of these three will be spoken of in its place later on. The first, which appeared immediately after the collapse of the Neuhof School, was a short paper in the 'Ephemerides' of Iselin, wherein he states the results of his experience as a teacher, and his views of what education should be. It is neither more nor less than a series of aphorisms, disconnected in form, and altogether destitute of literary skill and arrangement, but bound together by close unity of thought, intention, and subject-matter. They are the fruits of his past experience and reflection, but they contain the seeds of all his future labours and achievements in the cause of education. 'The Ephemerides of 1780,' so he writes some twenty years later at the zenith of his fame, 'bear witness that the dream of my desires is not more comprehensive now than it was when at that time I first sought to realize it.' The general tone and character of the 'Evening Hours' may be gathered from a few extracts:—

'All mankind are by nature alike,—they have but one path to contentment,—the natural faculties of each are to be perfected into pure human wisdom.

'The faculties grow by exercise.

'The intellectual powers of children must not be urged on to remote distances before they have acquired strength by exercise in things near them.

'The circle of knowledge begins close round a man, and from thence stretches out concentrically.

'Real knowledge must take precedence of word-teaching.

'As the education for the closest relations comes before the education for more remote ones, so must education in the duties of family membership come before education in the duties of citizenship. But nearer than father or mother is God: the closest relation of mankind is their relation to Him.

'Faith in God is the confiding child-like feeling of mankind towards the paternal mind of the Supreme Being. This faith is not the result of cultivated wisdom, but an instinct of simplicity; a childlike and obedient mind is not the consequence of a finished education, but the early and first foundation of human culture. Out of the faith in God springs the hope of eternal life. Children of God must be immortal.

'Belief in God sanctifies and strengthens the tie between parents and children, between subjects and rulers; unbelief loosens all ties, annihilates all blessings.

'Sin is the source and consequence of unbelief; it is acting contrary to the inward witness of right and wrong,—the loss of the childlike mind towards God.

'The loss of this childlike feeling of mankind towards God is the greatest misfortune of all the world; it renders all paternal education on the part of God impossible.

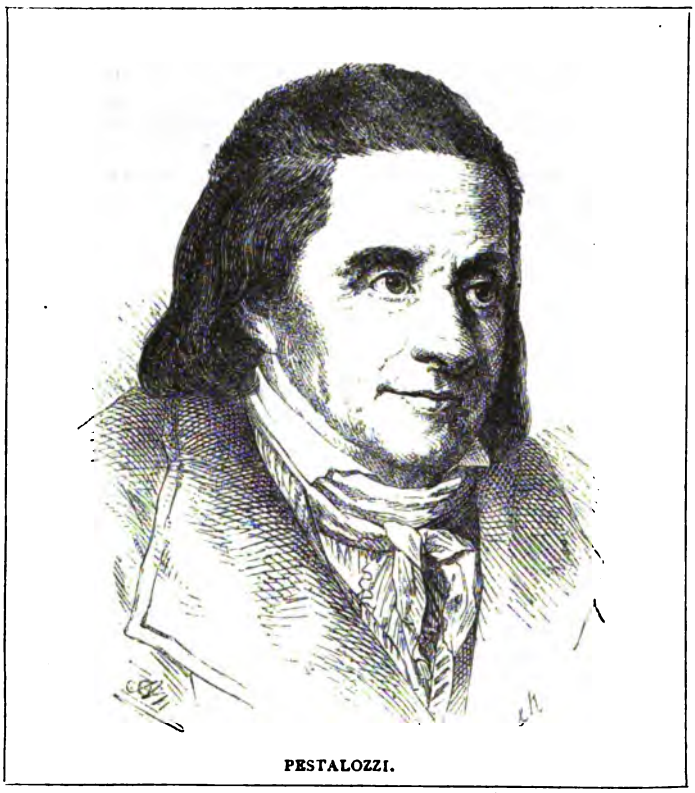
'The restoration of this lost childlike feeling is the redemption of the lost children of God on earth.

'The Son of God, who by suffering and death has restored to mankind the lost feeling of filial love towards God, is the Redeemer of the world; He is the Sacrificed Priest of the Lord; His Mediator with sinful man. His doctrine is pure justice, educative national philosophy; the revelation of God the Father to the lost race of His children.'

'Each of these aphorisms,' says one of Pestalozzi's biographers, 'is a text for a discourse; indeed, Pestalozzi's whole life is a paraphrase in act of these texts. We must lay it to the account of human infirmity, if the realization of his grand anticipations turns out but miserably, nay, only too often stands in glaring contradiction with them. The plan of an inventive architect retains its value even if the architect himself lacks the skill to carry out the building according to the plan.'

Up to this time, and indeed after the publication of his 'Evening Hours,' Pestalozzi appears to have been unconscious of the possession of any literary ability. And even when destitution stared him in the face, and he was compelled to look about for the means of subsistence, it was at a friend's suggestion that he tried his hand at authorship. He composed five or six

stories, most of which have been long since forgotten, on the plan of Marmontel's 'Moral Tales;' but the last of these, to which he gave the title of '*Leonard and Gertrude*,' was the foundation of all his future fame. It was written, as it were, in a vein of inspiration, and without effort. 'The story,' says he, 'flowed from my pen I know not how, and developed itself of its own accord, without my having any plot in my head, or even thinking of one. In a few weeks the book was there, without my knowing exactly how I had done it. I felt its value, but only as a man in his dreams feels the value of some piece of good fortune. I was hardly conscious that I was awake, and yet a new ray of hope began to dawn upon me when I thought that it might be possible in this walk to improve my pecuniary condition, and to make it more supportable to my family.' A friend to whom he showed his MS. pronounced it interesting, but at the same time so insufferably incorrect in language and unpolished in style that it was out of the question to publish it, and suggested that it should be previously revised by some practised writer. 'With no more pretension than a child,' Pestalozzi handed over the MS. to the individual recommended, but, 'what was my astonishment,' says he, 'on receiving the revision! It was a regular piece of divinity student's work, which completely changed the real picture of peasant life, simply and artlessly portrayed by me from nature, into something full of formality and affectation, and made the country-folk at the inn speak a stiff, pedagogic language which did not leave a vestige of the peculiarity of my book.' In high dudgeon he betook himself to his former friend Iselin, Recorder of Bâle, and timidly tried to gain his sympathy by telling him the story of his wrongs. 'But Iselin's opinion and his conduct,' Pestalozzi goes on to say, 'exceeded all my expectations. He said directly he saw the MS. of the work, "There is nothing like it of its kind, and the views which it advocates are an urgent necessity of our time. As for its defective orthography, that is a matter of minor importance and can soon be set to rights. I will arrange for the publication of the book, and see that you are fittingly remunerated."' Pestalozzi received a louis d'or per sheet, and a louis d'or per sheet seemed like wealth to him in his then destitute condition. When the book appeared the impression produced by it was extraordinary, extending far beyond the borders of Switzerland. The journals reviewed it, the almanacs quoted it; it was discussed in every society, and the Agricultural Association of Bern presented the author with their great gold medal of honour, accompanied with a letter of thanks. 'Pleased as I was with the medal,' he writes, 'and glad as I should have been to keep it, I was nevertheless compelled to part with it, and sold it at a goldsmith's for its value in money.'



PESTALOZZI.

The object of the book was, as Pestalozzi himself explains it, 'to bring about a better popular education, based upon the true condition of the people and their natural relations. It was my first word to the heart of the poor and destitute in the land. It was my first word to the heart of those who stand in God's stead to the poor and destitute of the land. It was my first word to the mothers of the land, and to the heart which God gave them, to be to theirs what no one on earth can be in their stead.'

The chief character in the story is Gertrude, the

wife of the easy-going nonentity Leonard, and the pillar of his house. Gertrude is the embodiment of Pestalozzi's ideal of the housewife and mother, and the way in which she brings up her children is the way in which he would have all children brought up. Her character and her influence are the lights of the picture which, on the whole, is a melancholy one, with the sombre background of a peasant community sunk in the deepest depravity.

It was in the endeavour to raise the labouring classes of his countrymen out of this condition by good elementary instruction, that Pestalozzi now recognised the work of his life. 'I desired nothing, and desire nothing else as the object of my life, but the welfare of the people, whom I love, and whom I feel to be miserable as few feel them to be miserable, having, with them, borne their sufferings as few have borne them.'

The friends who surrounded Pestalozzi seemed to have welcomed the success of his book chiefly as a proof that he would be able henceforward to earn his bread as a writer of fiction, ignoring altogether the purpose of the work, and the teachings of the experience which had cost him so dear. But others at a distance showed a deeper insight: invitations reached him from Savoy, from Austria, and from Italy, to settle in those countries, and the offer of a high appointment was made to him by the Grand Duke of Tuscany. The warmest admirer of Pestalozzi will hardly regret that circumstances occurred to prevent his being placed in a position of official or pecuniary responsibility. Lavater, who knew, loved, and appreciated him, is reported to have said one day to his wife, 'If I were a prince, I would consult your husband in everything that concerns the people and the improvement of their condition, but I would never trust him with a farthing of money.'

Of the other works of Pestalozzi published between 1780 and 1798 it is unnecessary to speak to English readers. During the whole of that period he was a philosopher and a theorist, but in 1798, the memorable epoch of the great French Revolution was to him, as to so many individuals and communities, the turning-point of a career. The revolutionary armies of France overran Switzerland, sweeping away the existing form of government, and all the Swiss cantons were consolidated into 'one indivisible Republic,' under five directors, after the French model. Of these directors one, who was named Legrand, was a personal friend Pestalozzi, and offered him his choice of an employment under the new government. 'I will be a SCHOOLMASTER,' was his reply.

On the 9th of September, 1798, Stanz, in Unterwalden, on the Lake of Lucerne, was destroyed by the French, and the whole surrounding district laid waste with fire and sword; in consequence of which a multitude of fatherless and motherless children were left unsheltered and uncared-for in the devastated villages and farms. Legrand now called upon Pestalozzi to repair to the ruins of Stanz, and to create a home and an asylum for the orphans there.

Accompanied by a single woman-servant, he took up his abode in the great Ursuline convent, which was set apart for his use by the authorities, but in a condition quite unfit for the accommodation of a number of children. Gradually he gathered round him as many as eighty wastrels from four to ten years old, 'horribly neglected, infected with itch and scurvy, and swarming with vermin;' their low-browed and inexpressive physiognomy and malign aspect affording a sure index of the mental darkness, the stubborn temper, the hopeless spirits, and the vicious habits on which the teacher would have to work. Not one in ten of them could say the alphabet. Such were the conditions of this 'educational experiment,' which Pestalozzi regarded as 'a sort of feeler of the pulse of the science which he wanted to improve'—a venturesome effort, indeed! 'A man with the use of his eyes would certainly not have ventured it; fortunately I was blind.' Pestalozzi gained much of his unrivalled knowledge of children's nature from the Stanz 'experiment,' which can hardly be called a failure, though it lasted less than a twelvemonth, and though his unsupported and unaided exertions in giving it a fair trial almost bought him to the brink of the grave. He was not only the teacher and trainer of those eighty children, but 'paymaster, man of all work, hospital-nurse, and almost housemaid, all at the same time; all the help,' says he, 'given them in their need, all the teaching they received, came from me; their food was mine, and their drink was mine. I slept in the midst of them; I was the last to go to bed at night, the first to rise in the morning.'

From this slavery he was emancipated just in time to save his life, by a change in the fortunes of war. The French army, hard pressed by the Austrians, fell back upon Stanz, and established a military hospital in the convent of the Ursulines. The scholars of Pestalozzi were dispersed, and he himself went up into the mountains, not so much to rest as to recruit his energies for fresh efforts.

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

Joint Author of 'The Field-Naturalist's Handbook.'

No. XIV.—THE MONKEY TRIBE.

PART II.

BEARING, perhaps, a more grotesque resemblance to the human countenance than either the gorilla or the chimpansee, the Orang-outan (*Simia Satyrus*) of Borneo and Sumatra, stands next upon our list. Of this animal there are two species, called by the natives 'Mias-kassar' and 'Mias-pappan' respectively. As the two animals, however, resemble each other closely, both in appearance and habits, a single description will suffice for both.

As regards the actual height of the body of the orang, accounts seem to vary to a very great extent. We read of orangs being slain which measured five, six, or even seven feet from the heel to the crown of the head, while other travellers state that these measurements are far in excess of the real dimensions of the animal. Mr. A. R. Wallace, the well-known naturalist, who devoted special attention to the animal during his visit to the Malay Archipelago, tells us that in no case has he known a mias to exceed four feet two inches in total height, and believes that this is the full limit to which the animal attains. It is cer-

tainly true that no larger specimen of the animal, either dead or alive, has yet reached Europe, and we may, therefore, doubt whether an orang of greater dimensions than those mentioned by Mr. Wallace has ever been met with.

In discussing this point, we must remember that animals invariably appear larger when living than when dead. Upon looking at an elephant of ordinary size, it seems impossible to believe that it is really no more than ten feet in height. Yet comparatively few specimens of that animal exceed that height, although we often hear of elephants fifteen, or even twenty feet in altitude.

Then again, as was mentioned in the first part of this paper, the height of the gorilla has been greatly exaggerated by travellers, who tell us that they have met with specimens at least seven feet in height. Yet, when the adult animal has been carefully measured, it has been found that at least eighteen inches must be deducted from this estimate, the largest gorilla ever yet brought to Europe standing only five feet six inches when placed erect.

Although the orang is very much inferior in size to the gorilla, its spread of arm is proportionately far greater. In a mias shot by Mr. Wallace, the height of which was four feet two inches from the crown of the head to the heel of the foot, the stretch of arm was seven feet nine inches, almost double the entire height of the animal. In a human being, the outstretched arms are as nearly as possible equal to the height.

When the orang is standing upright, or, to speak more correctly, in as erect a position as it is able to assume, the finger tips reach almost to the ground. When walking upon a level surface, the animal generally makes use of these long arms as crutches, placing the knuckles upon the ground, and swinging the body between them. Its gait is extremely awkward when once it leaves the trees, for the thighs are comparatively loosely jointed to the hip-bones. The powerful ligament which binds the two bones in the human frame is altogether wanting, and the tread of the animal is consequently very feeble and uncertain.

For its arboreal life, however, this structure is admirably adapted, for the legs are capable of far more play at the hip joint than is usually the case with the mammals, and can be twisted inwards in order to grasp branches, a feat which would be quite beyond the reach of any other animal.

Aided by its peculiarities of structure, the orang is particularly active amongst the branches, and will travel from tree to tree, without apparent effort, at the rate of five or six miles an hour. In order to pass from one tree to another, he invariably selects those whose twigs intermingle with one another, swinging himself across the intervening space by their assistance.

The orang-outan has a habit of constructing a kind of platform on which to rest, by interlacing the tree-branches with one another. This it does with great rapidity, its powerful limbs enabling it to twist even the large branches into position without any very great exertion. When pursued by hunters, and severely wounded, the animal has several times been known to construct one of these platforms, expiring upon its resting-place, and causing its pursuers considerable trouble in their attempts to dislodge the body of their victim.

The orang is by no means a social animal, as are so many of the monkey tribe, passing an almost entirely solitary existence in the trees. It is but very seldom, indeed, that two of these animals are seen together, the exception being almost invariably in the case of parent and young.

Only when compelled by necessity does the orang leave the trees, for it is almost always able to supply itself with the necessaries of life without descending to the ground. Its food consists almost entirely of fruit, which it generally prefers in an unripe condition, devouring even the most sour and acid varieties with apparent satisfaction. Buds and young shoots also form a part, although a minor one, of its diet. With water it can generally supply itself by means of that which it finds in the hollow of the leaves, being obliged to seek the requisite amount of liquid from other sources only during a very hot and dry season. Mr. Wallace states that upon one occasion only did he see the orang upon the ground, and that was in the case of two young animals, which were playing together in a dry hollow.

Unlike the gorilla, the mias seems to be very tenacious of life, and will receive the most severe wounds without succumbing for some little time. In one remarkable instance, a flattened bullet was found in the tongue of a slaughtered orang, the missile having entered the lower part of the abdomen and traversed the whole of the body, fracturing on its way the first vertebra of the neck. Yet, not only was this wound insufficient to cause instant death, but it also left the animal with sufficient strength to raise itself from the ground, where it had fallen from a considerable height, and to ascend a small tree with considerable speed, until a second ball put an end to its sufferings. In another case, an orang was fired at several times, and finally fell from the branches, both legs being broken, one hip-joint and the root of the spine completely shattered, while two flattened bullets were found in the neck and jaws. Yet the animal was still alive when it reached the ground!

The natives usually kill the mias by felling the trees surrounding the one in which it has taken refuge, in order to prevent any possibility of escape. Then the axe is applied to the tree in which the orang is seated, the animal being slain before it can recover the shock caused by the fall. Should the animal be allowed sufficient time to turn upon its enemies, it becomes a most formidable antagonist, making use of its teeth and powerful limbs with terrible effect.

Just as is the case with the gorilla, the character of the orang varies very much at different periods of its growth. When quite young, it is gentle and peaceable, exhibiting signs, also, of tolerable intelligence. As it increases in size, however, the bodily attributes gradually predominate over the mental, until, when it reaches its full development, the animal becomes morose, sullen, and ferocious to a very great degree.

Yet, when taken while still very young, before its savage instincts have become part of its nature, the orang has been completely tamed, an occasional gust of passion being the only sign of its natural disposition. Such animals have sometimes become completely domesticated, and have even been taught to sit at table during meals and behave with perfect propriety. In this country, however, an attempt to train the animal almost invariably fails, the climate proving fatal to the prisoner before many months have passed.

The hair of the orang is of a reddish-brown hue,

and falls in thick profusion over the face, back, breast, and arms. The face, also, is partly covered with a beard. The countenance has a singularly repulsive appearance, owing to the projecting jaws and the thick callosities upon the cheeks. The animal is found chiefly in the close swampy forests which are spread over so large a part of Borneo and Sumatra.

The latter of these islands produces a second ape, namely, the Siamang (*Siamanga syndactyla*). The specific title, which signifies 'joined-fingers,' refers to the structure of the hands upon the hinder limbs, the first and second fingers of which are united by a membrane as far as the middle of the second joint.

The siamang is smaller and more slightly formed than the preceding animals, and seems to form the connecting link between the apes and the gibbons, which are placed next upon the list. The arms are extremely long, their spread being about five feet six inches in a siamang three feet in height. In order to realize these dimensions, we must compare them with those of the human form.

As we have already mentioned, the arms of a well-proportioned man are, when extended, as nearly as possible equal to the entire height. In the siamang, however, they are nearly double. If we take a man six feet in height, and can imagine his arms to be eleven feet from finger-tip to finger-tip when fully stretched at right angles to the body, we shall gain some little idea of the wonderful length of limb of the siamang.

Beneath the chin of the siamang is a curious structure, consisting of a double pouch, formed by loose folds of skin. When the animal is angry or excited this pouch is inflated until it resembles a huge wen. Its object is not known, but many writers consider that it is connected in some way with the vocal organs.

The siamang is a very timid and wary animal, and is, in consequence, very seldom seen excepting by those who know how to look for it. At sunrise and sunset it assembles in great numbers, giving vent to the most hideous and discordant cries, which may be heard for miles around.

The GIBBONS evidently form part of the transition between the larger apes and the lesser monkeys and baboons, for in them are combined the principal characteristics of the two groups. Thus, while the form of the body, the absence of a tail, and the length of the limbs, shows them to be allied to the former animals, the callosities upon the hinder quarters prove them to be related to the baboons.

Resembling the apes in many respects, the habits of the gibbons are of a very different nature, and their structure is accordingly modified to suit their mode of life. The apes are formed for strength, and the gibbons for activity, and in this lies one of the great distinctions between the two families.

As far as lightness and agility are concerned, the gibbons far surpass all other monkeys in their arboreal evolutions. Not only can they travel among the branches with ease and rapidity, but they can launch themselves for wonderful distances through the air, passing from one tree to another, perhaps thirty or forty feet distant, without the slightest apparent exertion. Merely swinging the body for a second or two, as they cling to a bough, they hurl themselves into the air, never miscalculating the distance, or failing to grasp the bough at which they aim. And, more strange still, the impetus once gained no impulse seems required for subsequent leaps, the animal making spring after spring, and merely touching a branch here and there, as it passes along.

The structure of the paws is considerably modified in the gibbons, in order to aid them to the utmost possible degree in these wonderful evolutions. The thumbs of the hands, for instance, are destitute of the muscular prominence known as the 'ball,' and are scarcely opposable to the fingers, being placed almost in the same line with them. The reason for this is evident enough.

Upon watching a gymnast when practising upon a bar, it will be noticed that in many exercises the fingers are merely hooked over it, the thumb being placed upon the same side with them, and that it is not held in the grasp of the hand. Were it to be clasped both by thumb and fingers, the strain upon the muscles of the arm would be so great that the weight of the body could not be sustained for more than a few seconds. So with the gibbons, the hand is so formed as to fall naturally into the best possible position for grasping the boughs among which its entire existence is passed.

With the hinder feet, however, it is a different matter. They are not used for the same purposes as the hands, but serve chiefly to check the course during the long flight through space which the animal is in the habit of making. Therefore, a powerful grasp is a necessity, and accordingly the thumb is placed in the usual position, and is, moreover, extremely long and powerful.

The chest is broad and deep, in order to accommodate the capacious lungs which are needed to aerate the blood during the rapid movements of the animal, just as in the case with the greyhound, the race-horse, and other animals intended for active and long-continued exertion. Indeed, in every way the gibbons have been supplied by nature with evey possible advantage in the life they are intended to lead, these animals forming an admirable instance of the manner in which the structure of all living beings is adapted to suit the habits of their existence.

All the gibbons are natives of Asia, the first upon our list, namely the Agile Gibbon (*Hylobates agilis*), being found in Sumatra and Malacca.

Comparatively little is known of the habits of this animal, or, indeed, of any of the gibbons, when in a wild state, for it is so wary and timid that it is almost impossible for an observer to approach sufficiently near to watch its motions without the assistance of a telescope. Those, however, who have been fortunate to witness its evolutions in its native woods, have stated that it passes along from one tree to another with almost the rapidity of a bird, shooting through the air without any visible means of propulsion.

Some years back, a specimen of this monkey was brought to London, where it lived for some little time. A large cage was prepared for it, and fitted up with branches, in order to resemble as much as possible the trees among which its existence had formerly been passed. Here it used to astonish all beholders by the marvellous grace and activity which it displayed, launching itself between the boughs without the slightest apparent exertion, and checking its course at will, even in the midst of its longest flights.

While performing these feats of activity, the animal continually gives vent to loud cries of a very peculiar nature, ascending and descending the chromatic scale with considerable accuracy.

The agile gibbon does not seem to be gregarious, but is generally seen in pairs, therein differing from monkeys in general.

NEXT in order is placed a family of monkeys, the members of which may be distinguished at a glance from the preceding animals. The presence of a tail is sufficient proof that they belong to a different group, while the form of the body, the presence of cheek-pouches, and various minor details of structure, point to the same conclusion.

We now begin to find that the resemblance to the human form, which is strongly marked in the larger apes, is gradually becoming merged in the nature of the quadruped. The monkeys with which we have now to deal very seldom attempt to assume an erect position, and, even were they to do so, the long tail would at once deprive them of the likeness to the human body, which is so strongly marked in some of the preceding animals.

The difference between the two groups of monkeys is not only marked in the exterior form, but is also shown in various details of the internal anatomy. The stomach, for example, in the monkeys belonging to the present group is divided into compartments, its structure closely resembling that of the ruminating animals.

A very well-known animal of this family is the Hoonuman, or Entellus (*Presbytes entellus*), of India.

Strangely enough, when its constant depredations are taken into consideration, the entellus is considered as a sacred animal, and is treated accordingly, no one being allowed to molest it. Indeed, were a man to slay, or otherwise injure one of these animals, he would probably be punished with instant death.

Naturally enough, the monkeys take ample advantage of the forbearance shown to them, and become a perfect pest to the inhabitants of the towns, swarming in the streets, and stealing every object to which they take a fancy. Yet, no matter what mischief they may commit, no one is allowed to lay a finger upon them, and the only manner in which the shopkeepers can protect themselves from the ravages of the animals is by covering the roofs of their houses with thorn bushes, and so driving the monkeys from their principal resort.

The little monkeys which are generally connected with barrel organs are almost always members of the genus Cercopithecus, or 'Guenons.' In February, 1882, there were specimens of no less than eleven species belonging to this genus. Perhaps the Green Monkey (*C. callitrichus*) and the Grivet (*C. griseo-viridis*) are the most common in this country. In both these animals the hair looks as if it were washed with green. This, however, is only an optical deception. The real colour of the fur is yellow, alternating with black upon each hair.

While I was in the monkey-house a few days before these lines were written, I heard a great squealing from a White-throated Monkey (*C. albogularis*), and on looking into the cage, saw the monkey scampering round and round the apartment, rolling on the ground, and shrieking all the time as if he were being killed.

In fact, it was only bewailing its hard fate. In the same cage there is a larger monkey, which has hit upon a very simple plan for obtaining food. Instead of asking the visitors for food, it allows the smaller monkeys to do so, and when they have filled their pouches, chases and catches them, pulls their jaws open, and takes out the contents of the pouches. Most of them submit silently to their fate, or only raise a feeble cry by way of protest. The feelings of this particular monkey, however, seem to be very sensitive, and it delivers itself over to an absolute paroxysm of rage.

In this group we find the curious Diana Monkey (*C. Diana*), so called from a semi-human white mark on its forehead, something like the crescent which Diana is represented as wearing on her brow. Unlike Diana, however, it has a pair of rather long white whiskers, which descend far below the chin.

Then there is the Red Monkey, or Patas (*C. ruber*). The popular name is earned by the warm, ruddy hue of the fur upon the back and shoulders. The specimen in the monkey-house is a very quick, impatient animal, with a sort of imperious way about it, like that of a spoiled child.

The type of this group is the Mona (*C. mona*). This is a native word, and from the diminutive form of it 'monikin,' comes our familiar word 'monkey.'

(To be continued.)

—o—

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

'INERTIA and momentum.' I have placed these two terms together here, because in our ordinary text-books the words are generally coupled as though they formed a 'pair' of scientific terms; and that there was some sort of co-ordination between them; that they are used to designate two things intimately connected—that they were, in fact, something like the dual phenomena spoken of as 'light and darkness,' 'heat and cold,' 'electricity and magnetism,' 'rest and motion,' and the like. Hence it has come about that many science teachers think that when they talk of 'inertia' they must also discuss 'momentum.' Is it not a fact, however, that when our scientific authorities use the word 'inertia' they mean something quite different from 'momentum,' and not necessarily connected with it at all? The common explanation that I frequently hear given to boys and girls is this—that 'inertia' is the tendency of a body at rest to remain at rest; that 'momentum' is the tendency of a body in motion to continue in motion. It may seem startling to men read in science to hear that this is an error by no means confined to our younger teachers. I believe the mistake arises from two causes. First, the words are so often coupled; second, there is a too close adherence to the meaning of the Latin noun 'inertia,' or perhaps I ought to say, to the Latin adjective 'iners' in such phrases as 'inertes aquae,' stagnant or still waters. It may not, therefore, be out of place if I state briefly what I understand our great teachers—Huxley, Ewers, Tyndall, etc.—to mean when they employ these terms; for, as I have said before, let us endeavour to be, if possible, absolutely accurate, though elementary.

Matter is incapable of spontaneous change. It cannot, as far as we know, alter its condition except by the application of some external force. Whatever state it may be in, a change implies the operation of something outside itself. Of the various states in which matter may be, here are two, viz., *rest* and *motion*. Matter, therefore, at rest, or in motion, will maintain its respective state until some external force compels it to change that state. It is absolutely passive, and it is this 'passivity' of matter that is termed 'inertia.' Here again let me point out an error sometimes fallen into. A boy asks his teacher *why* a body tends to continue its motion, or to maintain its state of rest? and the teacher answers—Because of its inertia. No such thing. The term 'inertia' simply names the tendency, or the phenomenon apparent to our senses, not the cause or explanation of it. Why matter has this tendency we know not. We are quite as ignorant of the cause of inertia as we are of the cause of 'weight,' or the tendency of bodies to fall to the ground. We may, indeed, suppose a cause for the latter, and call this unknown cause 'attraction of gravitation'; still we are really as ignorant of the cause, now we have named it, as we were before. Again, even such an excellent authority as the 'Imperial Dictionary' states that 'inertia' is a property of 'dead' matter; that the difference between living and dead matter is that the latter is incapable of spontaneous change, implying that the former *could* alter its condition of itself. But can any matter, whether it form portions of animate or inanimate bodies, of itself change its state? It is true that the matter of vegetables and animals *is* continually undergoing change. But does this happen through the spontaneous action of the matter itself, or is it a result of the operation of forces? Surely the latter. All the phenomena that we group together and call 'life,' in the plant or in the animal, probably is but the sum of all the effects produced upon matter by the working of forces, some of which, indeed, we may at present be ignorant of. As to inertia being a property of inanimate matter only, I can say this much, that last night the tram-car started before I had taken my seat, and 'inertia,' without much ado, immediately seated me on a lady's lap; and I suppose I may consider myself as animate matter. To sum up, therefore. If I am standing up in a tram-car at rest, and the car suddenly starts, I shall probably fall backwards and sprawl on the ground, for the mass of matter constituting my body had a tendency to remain at rest; also, if I step out of a car in motion, and think to stand still in the road, I shall probably fall forwards upon my nose, for the like mass had a tendency to continue the motion communicated to it while in the car. This tendency in both instances is termed 'inertia.'

By 'momentum' is meant 'the energy possessed by a body in motion.' Let it be remembered that we define 'energy' as the 'power to perform work.' Also, that 'motion' is a result of the application of force. So that a body in motion has a store of force which has been, or continues to be, communicated to it. This 'store of force' the moving body is either giving out or ready to give out. Momentum may therefore be called the stored-up force in a moving body. Its amount is estimated by the weight of the body and its velocity. The relative momenta of bodies may be represented arithmetically by numbers, which are the products of their weights and velocities. Thus, if a body weighing twenty lbs. move ten feet per second, its momentum is four times that of another body weighing ten lbs., and having a velocity of five feet per second. It will now, I think, be readily seen how incorrect it is to include 'momentum' among 'properties of matter.' The boys easily grasp the subject, and are ready with numerous illustrations, which I need not here allude to.

I generally take up the subject of 'inertia' when treating of Newton's laws of motion. It is, in fact, expressed in the first law, viz., 'A body at rest will remain at rest, or if in motion will continue to move with uniform velocity in a straight line until acted upon by some external force.'

The subject of 'momentum' will follow close upon such a lesson as that of which an outline was given in last month's PRACTICAL TEACHER.

By my plan of encouraging the boys to ask questions, I am often led to see that my explanation has been weak, and that I have left only vague impressions on the minds of the scholars. Especially is this the case when teaching the subjects of 'actual energy,' 'momentum,' and the 'inertia' of moving bodies. A boy, for instance, asks the question—What is the difference between momentum and the tendency of a body in motion to continue in motion? I see, therefore, that I have to make it clear that the term 'inertia' is applied simply to the *tendency* to continue the motion, but momentum is the force of percussion that a body in motion always possesses. The tendency to continue in motion is a different thing from the percussive force a body acquires partly in consequence of that motion. In like manner, gravity or weight is the tendency of all bodies to fall to the earth, and is a different thing from the momentum or energy that a falling body acquires partly as a result of that tendency.

There is a considerable mistiness, that I have observed in many of our text-books, hanging about the endeavour to draw a distinction between 'actual energy' and 'momentum.' In the case of the mountain stream used as an illustration in my last lesson, I spoke of the pent-up water possessing potential energy, and of the sudden liberation of the water, and the consequent conversion of the potential into actual energy. Now, Ewers and others term this latter kinetic energy, from the Greek *kineo*—I move. Kinetic energy, therefore, would mean the energy of the mass of moving water. Huxley would say that such a mass of water 'acquires momentum' in its fall, and that this momentum is partly taken up by the paddles of the water-wheel, passed on to the machinery, and expended in the work of grinding the corn. Where, now, is the difference between Ewer's kinetic energy and Huxley's momentum? I must confess I see none, and would greatly prefer that the word kinetic were applied to the energy of all moving bodies, and that the term momentum were dispensed with.

As energy is the power of doing work, so the amount of energy is estimated by the number of units of work (foot-pounds) it is capable of performing. Thus we have recently heard of stored-up electric energy as being, in amount, equal to so many foot-pounds. In the case of the mountain stream above alluded to, the amount of work which the stream accomplishes in its descent is equal to the work done in raising the water to the height from which it falls. In the case of the dammed-up torrent, the potential

energy of the pent-up water equals the actual energy of the liberated water. So every cloud is a store of potential energy, which becomes actual when it descends, first to the land, and eventually to the sea, doing the work of conveying the solid earth and spreading it out on the floor of the ocean, to make future continents. The work here performed by the actual energy equals the work performed by the sun in raising all this water to the sky. These are instances of what is called the 'conservation of energy.'

In my next article I will reproduce the lesson upon 'Attraction of gravitation,' 'Gravity,' and 'Weight.'

—o—

'How I Teach Arithmetic.'

(*Continued from page* 599, *vol.* 1.)

BY WILLIAM SPENCER,

Author of 'Spencer's Exercises in Arithmetic.'

After Interest and Discount, I generally take (*d*) *Profit and Loss*, impressing well at the outset that rate per cent. here, as in what we have previously gone over, means at the *rate* of so much per £100; only in Profit and Loss *time* is not generally taken into consideration. We proceed at once to illustrate our *modus operandi*, subdividing the various phases under which a question may be presented as before.

(*d*1) *Adding or deducting a certain rate per cent. to or from a given price.* Examples:—I buy a horse for £100, and wish to gain 10 per cent. by him, then of course he must sell for £110, as he costs just a *cent.* (£100), and £10 added to it raises it to £110. If he cost £50, and I wish to gain 10 per cent., then, as he cost half a £100, the profit must be half of £10 = £5, hence the selling price will be (£50 + £5 =) £55. Again, suppose the horse cost £20, then as £20 is $\frac{1}{5}$ of £100, the profit must be $\frac{1}{5}$ of £10 = £2, hence the selling price must be (£20 + £2 =) £22. Here remark that if 5 horses had been bought at £20 each, £100 would have been spent, and the profit would have been £2 × 5 = £10, that is, £10 profit on the £100, or 10 per cent. Again, suppose ribbon to be bought at 8d. a yard, and that 25 per cent. is to be added to it; as 25 per cent. is $\frac{1}{4}$—£25 being $\frac{1}{4}$ of £100—then $\frac{1}{4}$ of 8d. must be added to it, making the selling price (8d. + 2d. =) 10d.

Work orally a number of questions before proceeding to slate or paper work, such as—Add 20 per cent. to 2s. 6d; as 20 per cent. is $\frac{1}{5}$, then $\frac{1}{5}$ of 2s. 6d. = 6d., hence the selling price is (2s. 6d. + 6d. =) 3s. Add 15 per cent. to £2 10s.; as 10 per cent. or $\frac{1}{10}$ of 50s. = 5s., then the remaining 5 per cent.; being half of 5s., the 15 per cent. must be (5s. + 2s. 6d. =) 7s. 6d., hence the selling price must be £2 17s. 6d. Or more shortly (50s. × 15) ÷ 100 = 7·5s. = 7s. 6d. Another, *e.g.*: Deduct 8 per cent. from £6 5s. £6 5s. = 125s., and (125s. × 8) ÷ 100 = 10s. the deduction, hence £6 5s. less 10s. = £5 15s. As an alternate method, *one* per cent. of 125s. is 1·25s., which × 8 = 10s., the amount to be deducted. Further examples might be —Add 16 per cent. to £3 10s. = £4 1s. 2$\frac{2}{3}$d.; deduct 30 per cent. from 1s. = 8$\frac{2}{3}$d.; add 60 per cent. to 3s. 6d. = 5s. 7$\frac{1}{2}$d.; deduct 12 per cent. from £80 = £70 8s.; add 17$\frac{1}{2}$ per cent. to 15s. Here 10 per cent. on 15s. = 1·5s. = 1s. 6d., and 17$\frac{1}{2}$ is 1$\frac{3}{4}$ times 10, hence the increment is 1$\frac{3}{4}$ times 1s. 6d. = 2s. 7$\frac{1}{2}$d., hence 15s. + 2s. 7$\frac{1}{2}$d. = 17s. 7$\frac{1}{2}$d. Ans. Add 130 per cent. to 5s. 6d. = 12s. 7$\frac{1}{2}$d.; add 14 per cent. to 60 guineas; here 60g. = £63, and £63 at *one* per cent. = £·63, which × 14 = £8·82 = £8 16s. 4$\frac{4}{5}$d., which, added to £63 = £71 16s. 4$\frac{4}{5}$d.

We are now prepared for working on the board, making two examples suffice. First—A grocer bought sugar at £1 7s. 6d. a cwt., what must he sell it at a lb. to gain 8 per cent. on it? Here (27·5s. × 8) ÷ 100 = 2s. 2$\frac{2}{5}$d. the gain per cwt., hence 27s. 6d. + 2s. 2$\frac{2}{5}$d. = 29s. 8$\frac{2}{5}$d. the selling price per cwt.; then 29s. 8$\frac{2}{5}$d. ÷ 112 = 3$\frac{51}{280}$d. Ans. Here, as the answer is between 3$\frac{1}{5}$d. and 3$\frac{1}{6}$d., I should remark that in actual trade the price should be 3d. or 3$\frac{1}{4}$d., as, although there may be 280ths of a penny in theory, there are, of course, none in reality. These remarks are necessary occasionally, as even fairly intelligent schoolboys have very hazy and mythical notions of the actual business of life.

Second example:—A dealer bought 1000 sheep for £1872 10s., and he sold 680 of them at two guineas each, at what each must he sell the remainder to gain 12 per cent. on his outlay? (£1872·5 × 12) ÷ 100 = £224·7 = £224 14s., then £1872 10s. + £224 14s. = £2097 4s., the selling price of the whole. Now 2g. × 680 = 1360g. = £1360 + 1360s. = £1428, selling price of the 680 sheep. Hence £2097 4s. − £1428 = £669 4s. selling price of the remaining 320 sheep, and £669 4s. ÷ 320 = £2 1s. 9$\frac{9}{10}$d. Ans.

(*d*2) *To find the gain or loss per cent. when the cost price and selling price are both given.*—First, as before (*d*1), work a number of short and easy examples orally. An article bought for £100 and sold for £120 must yield 20 per cent. profit. If the cost be £50, and the selling price £54, as £50 gains £4, £100 at the same rate would gain £8, that is, at the rate of 8 per cent. Cost £5, sells for £6 10s.; here £5 gains £1 10s., hence £100 would gain 20 times (the number of £5's in £100), £1 10s. = £30, or 30 per cent. Buys at 4s., sells at 3s. 6d.; here 4s. loses 6d., or $\frac{1}{8}$ of itself, hence the loss per cent. is $\frac{1}{8}$ of £100 = £12$\frac{1}{2}$. (Caution here that the gain or loss must be always (unless specially otherwise ordered) reckoned on the *cost* price, not on the selling price. Schoolboys, and sometimes *un*commercial small tradesmen, if able to reckon percentages at all, are apt to calculate on the latter.) Cost 8d., sells for 9$\frac{1}{2}$d.; here 8d. gains 1$\frac{1}{2}$d., or $\frac{3}{16}$ of itself, hence $\frac{3}{16}$ of £100 = 18$\frac{3}{4}$ per cent. Cost £22 10s., sells for £25; £22 10s. gains £2 10s., and the latter is just $\frac{1}{9}$ of the former, hence $\frac{1}{9}$ of £100 = 11$\frac{1}{9}$ per cent. Bought a house for £350, and sold it for £380; here 3$\frac{1}{2}$ hundreds gain £30, hence (30 ÷ 3$\frac{1}{2}$) = (60 ÷ 7) = 8$\frac{4}{7}$ per cent. gain.

An example for the board or slates:—A grocer bought cheese at £77 10s. a ton, and sold it at 9d. a lb.; find his gain or loss per cent. First, 2,240lb. at 9d. = £84 selling price per ton, and £84 − £77 10s. = £6 10s. the gain per ton, that is on £77 10s., hence the gain = $\frac{6\frac{1}{2}}{77\frac{1}{2}} = \frac{13}{155}$ of the cost, and $\frac{13}{155}$ of £100 = 8$\frac{12}{31}$ per cent. gain. Ans.

Another example, taken from my own exercises in 'Percentages,' No. 148:—A draper bought 240 yards of cloth for £150; he sold 100 yards of it at a profit of 20 per cent., 100 yards at cost price, and the remainder

at a loss of 10 per cent.; what did he gain or lose on the whole, and how much per cent.? £150 ÷ 240 = 12s. 6d. prime cost per yard, and 12s. 6d. × 100 = £62 10s., prime cost of 100 yards. £62 10s. + (¼ of £62 10s., 20 per cent. being ⅕ =) £12 10s. = £75 selling price of the first 100 yards. The second 100 yards sell for £62 10s., the cost price, and 12s. 6d. × 40 = £25, cost of the remaining 40 yards. As 10 per cent. is lost on this £25, the selling price is $\frac{90}{100} = \frac{9}{10}$ of £25 = £22 10s. Then £75 + £62 10s. + £22 10s. = £160 total selling price, hence £160 − £150 = £10, the total gain. Ans. Again, as £150 gains £10, £100 would gain $\frac{100}{150} = \frac{2}{3}$ of £10 = $6\frac{2}{3}$, the gain per cent. Ans.

(*d*3) *The selling price and gain or loss per cent, being given to find the prime cost.* Commencing orally as before—by selling a horse for £50 I gain 25 per cent. of his prime cost, find it. Had the horse cost £100 he would have sold for £125, hence the cost price is $\frac{100}{125} = \frac{4}{5}$ of the selling price, and $\frac{4}{5}$ of £50 = £40, the prime cost. By selling hats at 9s. each 20 per cent. is gained, find the prime cost. Had £100 been spent in hats they would have sold for £120, hence the cost is $\frac{100}{120} = \frac{5}{6}$ of the selling price, and $\frac{5}{6}$ of 9s. = 7s. 6d., the prime cost per hat. Skates are sold at 2s. 3d. and 10 per cent. lost on them; what did they cost? Supposing £100 worth of skates had been bought, they would have sold for £90, hence the selling price is $\frac{90}{100} = \frac{9}{10}$ of the cost price, that is, the cost price is $\frac{10}{9}$ of the selling price, and $\frac{10}{9}$ of 2s. 3d. = $\frac{10}{9}$ of 27d. = 30d. = 2s. 6d. If 15 per cent. be gained by selling at 9d., find the cost. The cost = $\frac{100}{115} = \frac{20}{23}$ of the selling price = $\frac{20}{23}$ of 9d. = $\frac{180}{23}$d. = $7\frac{19}{23}$d. Ans. When 18 per cent. is lost by selling at 9s. 6d., find the cost. £100 worth would have sold for £82, hence the cost is $\frac{100}{82}$ of 9s. 6d. = 11s. $7\frac{1}{41}$d. A selling price of £8 gains 10 per cent.; find the cost = £$7\frac{3}{11}$. After giving a score or two of such oral exercises, I should then work some half dozen on the board, two of which we will now work out. First,—by selling tea at 2½d. an oz. a grocer gains 28 per cent. on the prime cost; find the cost to him of a chest containing 60 lbs. 2½d. × 16 × 60 = £10, the selling price of the chest. Had he spent £100 in tea it would have sold for £128, hence the cost price is $\frac{100}{128}$ of the selling price, then $\frac{100}{128}$ of the £10 = £7 16s. 3d. Ans.

Second, *e.g.*: A grocer who takes over the counter £16 10s. a day, clears 17½ per cent. on the prime cost of his goods; find his profits in a year of 310 days. 'Percentages,' No. 138. The yearly receipts are £16·5 × 310 = £5115. As he gains 17½ per cent. on the prime cost, the goods that cost £100 would sell for £117½, hence the profit is £17½ out of every £117½ taken over the counter, that is, $\frac{17\frac{1}{2}}{117\frac{1}{2}} = \frac{35}{235} = \frac{7}{47}$ of the amount taken. Hence $\frac{7}{47}$ of £5115 = £761 16s. $2\frac{8}{47}$d. Ans.

(*d*4) *When the profit or loss per cent. on one selling price is given, to find the profit or loss on another selling price.* First a few oral examples, although they are somewhat more difficult to work purely mentally than those previously given under the subdivisions of (*d*). By selling ribbon at 8d. a yard 20 per cent. is gained; what would be gained per cent. by selling it at 9d.? When sold at 8d. a yard, a quantity of ribbon that cost £100 would sell for £120, then, if sold at 9d., $\frac{8}{9}$ of £120 = £135 would be received for it, hence the excess above £100 (the prime cost) = £35 the profit, or 35 per cent. Another, *e.g.*: By selling cloth at 10s. a yard a draper loses 5 per cent. on the prime cost; what will he gain or lose per cent. if he raises to 12s. a yard? Here the selling price of the cloth that cost £100 is £95 when sold at 10s. a yard, and when sold at 12s. a yard the receipts for £100 worth would be $\frac{12}{10} = \frac{6}{5}$ of £95 = £114, hence 14 per cent. is gained. If a price of 4s. 6d. gains 12 per cent., what would be the effect per cent. if the article were lowered to 3s. 6d.? As £112 is the selling price at 4s. 6d. of what cost £100, then, as 3s. 6d. is $\frac{7}{9}$ of 4s. 6d., $\frac{7}{9}$ of £112 = £$87\frac{1}{3}$ would be the selling price of what cost £100 when lowered to 3s. 6d. a yard, hence £100 − $87\frac{1}{3}$ = £$12\frac{2}{3}$ the *loss* per cent

Examples for board: By selling coats at 37s. 6d. each 15 per cent. is gained; what would be the gain per cent. by selling them at two guineas each? In the first case the coats that cost £100 would sell for £115, and at the latter price, bringing both the prices to sixpences, $\frac{84}{75} = \frac{28}{25}$ of £115 = £$128\frac{4}{5}$ would be got for £100 worth, hence the gain is $28\frac{4}{5}$ per cent. If 8 per cent. be lost by selling hats at 11s. 6d., what would be the gain or loss per cent. by selling them at 13s. 9d.? At 11s. 6d. each the hats that cost £100 would sell for £92, then, bringing both prices to threepences, at 13s. 9d. they would sell for $\frac{55}{46}$ of £92 = £110, hence the gain would be 10 per cent. Of course every question of this nature (*d*4) may be worked out by *two* steps—first by finding the prime cost, and then by finding what per cent. of gain or loss the proposed price is on the cost, thus, as 8 per cent. is lost by selling at 11s. 6d., the cost price must be $\frac{100}{92}$ of the selling price, that is, of 11s. 6d., hence $\frac{100}{92}$ of $\frac{23}{2}$s. = 12s. 6d. cost price. Again, 13s. 9d. is $\frac{55}{50} = \frac{11}{10}$ of 12s. 6d., consequently the selling price of £100 worth of goods at 13s. 9d. would be $\frac{11}{10}$ of £100 = £110, hence the gain is 10 per cent.

Another, *e.g.*: A ship could have been sold for £36,920, gaining 4 per cent. on its original cost, but prices falling it was afterwards sold for £35,000. What was the gain or loss per cent? If sold for £36,920, every £100 of its original cost would have sold for £104, but as it only sells for £35,000, then $\frac{3500000}{3692000}$ of £104 = £$98\frac{48}{71}$ would be obtained for £100 of its cost, hence £100 − $98\frac{48}{71} = 1\frac{23}{71}$ loss per cent. Or, by first principles, as 4 per cent. is gained by selling at £36,920, the prime cost must have been $\frac{100}{104}$ of £36,920 = £35,500. Then £35,500 − £35,000 = £500 loss on the prime cost, that is, the loss is $\frac{500}{35500} = \frac{1}{71}$ of the cost, and $\frac{1}{71}$ of £100 = $1\frac{29}{71}$ loss per cent. Ans.

(*d*5) *The profit or loss at one selling price being given, to find another selling price yielding a given rate per cent. of gain or loss.* Proceeding as before—By selling an article for 6d. 20 per cent. is gained; at what price must it be sold to gain 50 per cent.? Here show that if £100 had been spent in these articles the lot would have sold for £120 at 6d. each; but the seller wishes to receive £150 for what cost £100, hence each article must be sold for $\frac{150}{120} = \frac{5}{4}$ of 6d. = 7½d. Ans. Or, as under (*d*4), working from first principles, we will first find the prime cost of an article; as £20 per cent. is gained, £100 worth would sell for £120, then the cost price is $\frac{100}{120} = \frac{5}{6}$ of 6d. = 5d. Fifty per

cent. added to 5d. = 7½d. Ans. If 10 per cent. be lost by selling knives at 1s. 6d. each, what must they be sold at each to gain 30 per cent.? Here £100 worth of knives would sell for £90, but £130 is required for the £100 worth, hence each knife must sell for $\frac{130}{90} = \frac{13}{9}$ of $\frac{3}{2}$s. $= \frac{13}{6}$s. = 2s. 2d. Ans. Or, working by the two steps, we find the cost price to be 1s. 8d., which, increased by 30 per cent., {(20d. × 30) ÷ 100 = 6d.} = 2s. 2d. Ans. A price of 5s. gains 16 per cent; what price for the same article would lose 16 per cent.? Work,—$\frac{84}{116}$ of 5s. = $3\frac{18}{29}$s. = 3s. $7\frac{13}{29}$d. An article on which $12\frac{1}{2}$ per cent. is lost by selling it at 15s. is raised so as to gain 20 per cent. Find the new price. Here $\frac{120}{87\frac{1}{2}} = \frac{240}{175} = \frac{48}{35}$ expresses what the new price is of the old one, hence $\frac{48}{35}$ of 15s. = 20$\frac{4}{7}$s. = 20s. 6$\frac{6}{7}$d. Examples for board or slates:—By selling hay at £4 2s. 6d. a ton a dealer gains 7½ per cent. What must he sell it at a ton to gain 18 per cent.? At £4 2s. 6d. a ton the hay that cost £100 would sell for £107½, but £118 is wanted for it, hence, bringing both to halves, $\frac{236}{215}$ of $\frac{35}{8}$ £ = £4 10s. 6$\frac{30}{43}$d. Ans.

Three per cent. being lost by selling sugar at 2½d. a lb., what will be the result by raising it to 2¾d.? As 2¾d. = 11 farthings, and 2½d. = 10 farthings, the result would be $\frac{11}{10}$ of £97 = £106·7 as the selling price of £100 worth, that is a *gain* of $6\frac{7}{10}$ per cent.

By selling cheese at 9d. a lb. a grocer gains 20 per cent., what would be his gain or loss per cent. by selling 13 cwt. 2 qr. 21 lb. for £50? There are 1533 lb. in the given weight, and £50 ÷ 1533 = $7\frac{269}{533}$d. a lb. As the price is lowered from 9d. to $7\frac{269}{533}$d. a lb., we will bring both these prices to 1533rds of pence, being 13,797 and 12,000 respectively; hence, at the latter price £100 worth would sell for $\frac{12000}{13797}$ of £120 = £$104\frac{568}{1533}$, hence the gain is $4\frac{568}{1533}$ per cent. Ans.

(To be continued.)

Prize Letter.

By FREDERICK J. GOULD, Turin Street Board School, Bethnal Green, E.

To a young Pupil-teacher just commencing his career.

MY DEAR HARRY,—I am very pleased to hear from Mr. Waters, your head master, that you have just passed the Candidates' Examination. He tells me that the Inspector's report describes you as having done 'well.' This is a success which we expected you to achieve; and it is as gratifying to your friends as it can be to yourself. Mr. Waters assures me that, by your persevering and painstaking study, you deserved to pass with flying colours. That is still more gratifying. You remember the lines in the 'Poetical Reader,'

> 'Tis not in mortals to command success,
> But we'll do more, Sempronius, we'll *deserve* it.'

Still, my dear boy, you will, I have no doubt, bear in mind that as 'Rome was not built in a day,' so a candidate will not grow into a full-fledged teacher by passing *one* good examination. You have now four years of Pupil-Teachership before you; then, probably, two years in a Training College; and two years even beyond college life, ere you can receive the parchment which will entitle you to call yourself a 'Certificated Master.' Here is a long journey of eight years to travel; and even when you have safely reached the last stage of the journey, and, as it were, planted your victorious flag on the summit of the Hill of Difficulty, you will discover that there are yet fresh lands to conquer, and new lessons for the schoolmaster to learn.

But though Rome was not built in a day, still every day saw its share of the building completed. And though you have eight years in which to build up a good character and a useful experience, yet character and experience are composed of every-day trifles. You have already laid a solid foundation; and I believe you have acquired the excellent habit of dividing your year's work into smaller portions, and giving to each a certain number of weeks or months. If you continue to labour on this principle, you will get through double the amount of study that you could accomplish by cramming up at the last moment. There is a Latin adage which bids us 'hasten slowly.' You recollect, in the parable of the 'Sower,' the fate of the corn which sprang up quickly because its roots grew in shallow soil. The good ground matured the seed more slowly, but much more surely.

You have now been teaching for several months, and you have had sufficient experience to enable you to judge fairly well whether you will like the work or not. You believe you will. This is a great step in advance. A man may dislike account-keeping, and yet make a fair show as a clerk; a farmer may regret that he was ever called to the plough, and yet, by diligence, he may maintain his farm in good order; but for a teacher to feel his daily labour a disagreeable burden, it is a sad and disastrous thing indeed. It takes away the value of his work and the happiness of his scholars. As you go on endeavour to ascertain the state of your mind on the subject. A German writer relates a capital story of a father who committed his son to the care of a celebrated tutor. He expected his child would become a professor. One day he saw a cloud of dust approaching; then a troop of horsemen appeared. His son was leading the way, the most expert rider of them all. His master had thus discovered the occupation he was best fitted for; though doubtless the father was much astonished. The moral conveyed is that most men will find their talents lie in some particular direction, which they would do well to find and follow steadily. To become a true teacher is a fine and worthy aim. A sculptor has to spend a very long period in practice before he can chisel such beautiful marbie figures as may be seen in Westminster Abbey. It is a nobler lesson to learn how to shape a human mind, and it needs great patience and attention. At the same time I do not mean you should be so taken up with the duties of teaching as to forget everything else. Just as the sculptor is not wasting his time when he stops to sharpen his graving tools, so the pupil-teacher will not lose any valuable knowledge by giving some of his time to cricket, football, or swimming. You will use the chalk or the pointer all the better after having wielded bat and ball. However, after the long score you obtained at the match with the British school, I am not afraid at present of your forgetting the fact that sound mind and sound body go together.

Besides, without good health a teacher's life must usually be an unhappy one. More than any other profession, it is crowded with little worries which are vexing to a person in the best of health, but are too much for a weakly constitution to bear. These 'little worries' are worse than the great ones, for they come so often and unexpectedly. Perhaps you have heard of the sailor who endured the pain of having a limb cut off very patiently, until the surgeon happened to run a pin into Jack's leg. He bawled out most lustily, for though it was only a trifle, it came unawares. You know what inconvenience is caused by children coming late to school, losing pencils, etc. Looked at singly these are but small annoyances, but all combined they make up a large amount of worry. In addition to this, the teacher is obliged to meet the opposition of ignorant parents, who do not understand what benefit their children will receive from education. There is not now so much opposition, perhaps, as there used to be, because people are beginning to see that the teacher is not an enemy, but a friend.

And as in the well-known history of the shield, so here also there are two sides to the question. We may turn, then, from the more gloomy prospect, and find much en-

couragement awaiting us. In our palaces and cathedrals there are statues in memory of poets, artists, warriors, and statesmen, but very few indeed to teachers. Of course the poet Shakespeare was a teacher when he taught men sublime lessons; but I am speaking of school-teachers. They do not, however, need such memorials. The grand inscription in St. Paul's tells us not to seek Sir Christopher Wren's monument among the marble groups and busts, but to 'look around.' And so we need only look at the nation itself to see the teacher's monument. Of course I do not mean that all the knowledge and wisdom in the nation comes from the teacher. But whatever wise and learned men publish, that the schoolmaster takes and explains to his scholars. These scholars in another quarter of a century will form the nation. When, therefore, the people engage in some noble action, as in 1833, when Great Britain bought the freedom of the slaves, or as in 1872, when this country ended its quarrel with America without the aid of war, then the teacher can exclaim, 'I have had a share in this movement.'

Again, in teaching others we shall find our own knowledge increase. No doubt you have yourself felt that in explaining a simple problem in arithmetic to the 2nd Standard you obtained a stronger grasp of the principle on which it was worked; or in clearing up a little difficulty in spelling, such as the catchword in 'There is their father,' you were afterwards much less likely to make the mistake yourself. You may have met with the anecdote of the Alpine traveller who, descending a mountain during a storm, found a man lying half-buried under a snow-drift. He was himself extremely cold, but in rubbing the body of his companion in distress, in order to restore warmth, his own blood began to circulate more freely. Thus in many ways, and especially in imparting knowledge, 'it is more blessed to give than to receive.'

And once more, it is not only important to the nation, and beneficial to ourselves, but to be successful in adding to the knowledge of our scholars is one of the greatest of pleasures. It is like aiming at a target, and discovering that we have struck the golden spot in the centre. We can imagine the triumph of James Watt when he saw his first engine at work, or of Lesseps when he beheld the first vessel gliding along the Suez Canal. It is as pure a satisfaction that the teacher experiences when he has explained the meaning of a beautiful poem, or given a lesson in geography, or on some great character in history, and sees the little faces before him light up with intelligence and pleasure. He has as much right to feel pride in his success as the soldier upon whose breast the Queen is pinning the 'Victoria Cross.'

You remind me just now, Harry, of the young champion going out to do battle. It is indeed a battle, but against ignorance and darkness. Well, and what armour can I furnish you with? I suspect that if I put into your hands the Government Code, or the Blue-book which you have seen Mr. Waters reading, you would, like David, find this kind of armour more cumbersome than helpful. However, I fancy I can choose for you 'five smooth stones out of the brook,' which will be more useful.

1. The first 'stone' is GOOD TEMPER. To possess this is worth more than half a dozen Science certificates. A young man may know physiology, or geology, or zoology, but if he loses his temper when his scholars are idle or careless he will not succeed in imparting much of his learning to them. A teacher with a smile on his face may not know French or Latin, but what he does know he will teach better. A little door well oiled is thought more of than a ponderous gate that is too rusty to open. Shouting in an ill-tempered manner at a lazy boy is certainly enough sometimes to awaken his attention and drive a fact into his head, but it is doubtful whether the knowledge will have any good effect upon his mind. We may fill a scholar's memory, but if our mode of instruction causes him to dislike us we pay a very dear price for our success. In many instances, however, we shall not even be rewarded with this success. Ill-temper often frightens a dull scholar, and makes him quite unable to understand the lesson we wish him to learn. When we have to deal with tiresome children or dunces, the best thing we can do is to put a cheerful face on the matter, and try and think of some means to attract their wandering thoughts. A good-humoured master, on opening a new school, found the children terribly wild and noisy. Instead of attempting to roar them down into quietness, he fetched a broomstick, stuck a nightcap on the top, and held it up before the turbulent little assembly. Awe-struck at the sight of the strange object, every one ceased talking, and a great calm followed the disturbance. Quietly putting away the broomstick, the teacher proceeded to address his scholars, and soon interested them in their proper work. Of course it would not usually be advisable to erect broomsticks before a troublesome class, but cheerfulness and good temper are in any case the best passage to order and discipline.

2. The second 'stone' is the SPIRIT OF PLODDING. You know what plodding is, for you are, I am glad to say, a plodder yourself. The prophet Isaiah gives a fine description of plodding when he says that all teaching must be 'precept upon precept, precept upon precept; line upon line, line upon line; here a little, and there a little.' Or, as old Humphrey expressed it, in one of his homely pieces of advice, 'a little at a time, and go on.' A steady stream of industry flowing all through the course of the day or the year will do more good to teacher and scholar than sudden 'spurts' of work. Have a time-table for your private studies, and keep to it; and carefully follow your class time-table. A teacher may, for example, throw aside almost every subject for the sake of drawing, because he is expecting an examination shortly. His scholars may appear to do well; but in the long run they will make very poor draughtsmen, besides being backward in other neglected subjects. In your programme for the coming year you will have to practise tracing the maps of European countries from memory. It is clear that nothing near perfection in such work can be arrived at without carefully repeating each exercise week after week. If you were to leave it all to the last few months of the year the Inspector would no doubt be entertained with some ridiculous performance which he would have a hearty laugh at, and possibly write about in that awful Blue-book. And lastly, by adhering daily to your time-table, whether privately or in class, you and your scholars will form the habit of regular effort, which will prove of great service in the future. The pupil who has thus been trained at school will be just as precise and methodical whether in the counting-house, the shop, the steamboat, or the signal-box.

3. The third 'stone' is WATCHFULNESS. Now and then your class will be set a portion of spelling, writing, etc., which they will have to do unassisted. Do not think you are then at liberty to sit down and leave them to themselves altogether. Without interfering, or seeming, like some policeman, to be spying out any wrong-doing, you can still prevent a thoughtless pupil from seizing an advantage for idleness or mischief. It often happens that a great deal of disorder is created in consequence of some trifling misconduct, unnoticed at the time by the teacher. One thing leads on to another, and an unpleasant state of affairs may occur which is much more difficult to put right than it would have been in the first instance. 'Behold how great a matter a little fire kindleth.' You know how in ancient cities a high tower stood beside the gate, whence a watchman always kept a keen look-out. Every teacher, too, must thus maintain a constant guard against the approach of disorder.

4. The fourth 'stone' is MODESTY. There is a common saying that schoolmasters are conceited. There may be some truth in this. The man that is always looking down upon smaller minds is apt to think himself very big and important, unless he is careful to nip his pride in the bud. You have read 'Gulliver's Travels'? You remember that when the captain was in Lilliput he appeared quite a giant. When, however, he visited a country whose inhabitants were of prodigious size he

had to confess that he was very insignificant indeed. It is good sometimes for the teacher to compare his own knowledge with that of the great and learned. And even Sir Isaac Newton, at the close of his life, declared that, notwithstanding the vastness of his learning, he felt as if he had only been gathering shells on the beach like a child, while the broad ocean of truth lay all before him, and stretching far beyond his sight. Now you may have a question put to you by one of your class which you cannot answer. It is better to reply 'I do not know,' or 'I will try and find out by next time,' than to hide your ignorance under a poor attempt to display knowledge. Occasionally a scholar will give you some little information that you did not yourself possess. If, for example, you were giving a lesson on the elephant, you might happen to have the son of an ivory turner in your class. He could probably tell you something of the manufacture of ivory articles which you would not meet with in your 'Natural History.' Do not put the speaker down, but let him briefly say what he knows. His schoolfellows will in all likelihood recollect some facts about ivory the better for obtaining them in this manner. Neither will they think the worse of a teacher who shows himself willing to learn even from his scholars.

Then with regard to your own private work, you may by dint of diligence be fortunate enough to earn frequent certificates of excellence and commendations from the Inspector and managers. Endeavour not to let your vanity get the upper hand if a companion or acquaintance gains lower marks or less praise. And this for two reasons: first, you may hurt his feelings, making him less friendly and perhaps discouraging him; and, secondly, you may slide into a careless habit of always expecting success, and so possibly be some day surprised by a failure. In these days the teachers of the elementary schools, if all marshalled together, would compose an army equalling in size many of those which have 'marched past' her Majesty. There are men of all kinds of talents, and perhaps not one amongst them all surpasses his comrades in every point. The best, therefore, is in some points inferior to his neighbours, and may gather a harvest of useful hints from his fellow-teachers.

5. The fifth 'stone' is HONESTY. You may be somewhat astonished that I should place this quality in my list. Of course I never suppose you would pilfer or run away with the school pence or other property. But honesty includes more. There is the important matter of keeping registers, which you will have to deal with later on. But it is as well you should know that several teachers have lost their characters and situations by entering false marks of attendance or absence in order to gain money. Such deceit is unknown to the scholars. There are, however, certain kinds of dishonesty which are easily noticed by them. For instance, a young teacher may be left in charge of a standard or class, and the head-master be out of sight or hearing. Children have sharp eyes, and if they observe their own teacher slipshod in his duties when the master is at a distance, you cannot expect them to be more thoughtful than the person who is appointed to overlook them.

These, then, are my 'five stones:' Good Temper, Industry, Watchfulness, Modesty, and Honesty. They will prove as serviceable as the pebbles in David's bag.

In the next place, let me turn for a few moments to the course of study which lies before you, and give you a few hints concerning the manner in which you may pursue each subject. We will begin with *Arithmetic*. Pay special attention to the problems which you will find in every book of arithmetic. A learner will sometimes work a large number of plain sums that are all built up on exactly the same model, proudly ticking off exercise after exercise as finished and understood. In another week he may return to a rule and find it has slipped his memory. This is because he has neglected the problems, in which something more than the straightforward example is to be thought of. It is as if a child were always conning over columns of words of the same kind and never writing sentences from dictation. In a sentence words are connected with other words, and the use of each word, as well as the meaning of the whole sentence, has to be comprehended before the spelling can be correct. The problem in arithmetic is like the sentence. Each part must be carefully noted and compared with other parts before the problem can be fitted in with the rule.

Grammar.—The entire study of grammar rests upon one little word—*why?* At every step ask yourself, Why is this? Why is that noun abstract? Why is this verb infinitive? Why is that word a noun in one phrase and an adjective in another? And so on. Perhaps you have already found that the rules of grammar differ in different books; and an old edition will often vary from the newest one. This is an advantage in one sense, because it makes the learner frequently ask, Which way is best? Why is the new way better? or How is it people still hold different opinions concerning the use of a certain word, and the proper way to parse it? You may feel sure the Inspector will make allowance for any error you may make in the case of doubtful words, so long as your mistake shows that you have used your brains and tried to think for yourself.

Geography.—Borrow and read, if you can, any story of travel, like the 'Voyage in the *Sunbeam*,' or any book giving an account of men like Livingstone, of Polar expeditions, or of tours in various European countries. Make every use you can of the newspaper, and select from among the letters and telegrams any information that may bear upon your year's work. If you are engaged on Russia, you will be helped by reading messages announcing the breaking-up of the ice on the Neva, or the state of trade at Odessa. Under the heading of Italy you may meet with reports of inundations at Rome, eruptions of Mount Vesuvius, etc. At times you will find the daily paper correct some statement in your text-book. For, of course, as the condition of European countries is seldom the same for ten years together, it is impossible to keep books up to date with the last changes.

History.—If you get the opportunity, read 'Hereward the Wake,' or the historical tales of Sir Walter Scott, such as 'Ivanhoe.' These and similar books will please you far more than the adventures of pirates and detectives, now published in cheap numbers. They will also render you aid in remembering the periods of English History. You will not be able to take everything for granted that you are told in these narratives, but they will help you to imagine the condition of the people in times gone by. In addition to this, visit, if possible, the Tower of London, where Sir Walter Raleigh, and Sir Thomas More, and other celebrated persons were imprisoned or executed; or the South Kensington Museum, where you will see a perfect copy of the interesting Bayeux tapestry, and pictures and monuments that will remind you of or teach you many great events from the earliest age to the present. Learn all you can about the castles, abbeys, or battle-fields in your county. A pupil-teacher living near Windsor, or Worcester, or York would thus be able to treasure up an amount of historical knowledge without turning a page of a printed book.

Penmanship.—I have here only one piece of advice to give. If you keep private note-books of any kind, let them be neatly and clearly written, with free use of the ruler and red ink, etc. It often happens that note-books are carelessly scribbled, because their owners fancy none will set eyes upon the manuscript but themselves. That may be so, but the untidy habit will go far towards ruining a good handwriting.

Composition.—The point to aim at is to write so that persons may read your production with pleasure, and without hesitating about your meaning. 'Use short sentences and simple language' is a good rule. But a long sentence containing difficult words may be so arranged as to convey the sense better and more quickly than an awkward sentence of very short words. So let your chief motto be 'Clearness.'

Music.—In singing, do not force your voice in attempting tenor or bass parts, as it must be guarded from any

strain for several years to come. Copy out the pieces that are being practised in your school. This will assist you in learning the theory of music, as it furnishes a host of examples of keys, intervals, etc.

Drawing.—Now that you are working for your 'D,' begin drawing not only from copies or the ordinary wooden models, but also from larger objects. Try the school or church. Draw plans of these buildings, and geometrical patterns for flower-beds, ornamental pavement, etc. Perhaps some of your attempts in this direction will not appear very satisfactory, but the practice will do you good.

This letter, my dear Harry, has been so lengthy that I hope a few words more will not quite tire you out. I will just add a kind of short postscript under three heads :—

1. Let no quarrel or ill-will arise between you and your fellow pupil-teachers on account of any little item of school duty which may not be assigned to any one in particular. A black-board left uncleaned or an ink-well unfilled is but a trifle; but sometimes disputes will crop up even over such trifles as these. Sooner than allow any unpleasantness, put things to rights yourself, unless it is distinctly understood that it is not your place to do so.

2. Keep a watch over any of your personal habits which may be likely to set a bad example to your class, such as standing in ungainly positions, fidgeting, biting your nails, etc. These, again, are only trifles; but you know how, for example, in a drawing the greater part of which is well executed, a few small awkward touches may spoil the effect. So it is with our conduct before the eyes of others.

3. Be careful, when you are out of school, to avoid acting in any way which may make your scholars respect you less when they meet you next day in school. Your good sense will suggest to you what kind of behaviour to abstain from. I should not expect you, Harry, to do anything very improper, but it is good for us all to be on our guard when our conduct in public may be noticed and perhaps imitated.

Much of what I have written I have no doubt you have heard or will hear from Mr. Waters. But whether the advice proceeds from him or myself, I feel sure you will give it your attention. You have commenced your career well: may you progress from good to better. And 'study to show thyself approved unto God, a workman that needeth not to be asnamed.'

Your sincere friend,

Jan. 21st, 1882. HOPE.

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

(1) Add together thirteen, six hundred and eighty, and fifty-nine. Ans. 752.

(2) From one thousand eight hundred and thirty, take seven hundred and ninety-two. Ans. 1038.

(3) Take eleven from sixteen hundred and eight. Ans. 1597.

STANDARD II.

(1) From forty-three thousand and sixty-one, take eight thousand seven hundred and sixteen. Ans. 34,345.

(2) Multiply fifty-one thousand nine hundred and nine, by forty-eight. Ans. 2,491,632.

(3) Divide fifteen thousand three hundred and seventy-five, by six. Ans. 2562,—3.

(4) Take nine thousand one hundred and eighty, from thirty-six thousand two hundred and seventeen. Ans. 27,037.

(5) Multiply seven thousand four hundred and eight, by seventy-six. Ans. 563,008.

(6) Divide twenty thousand three hundred and six by six. Ans. 3384,—2.

STANDARD III.

(1) How many times is seventy-eight contained in seventy thousand and forty-four? Ans. 898 times.

(2) From nine thousand and sixty pounds fifteen shillings and fivepence, take eight hundred and eighty pounds nineteen shillings and tenpence farthing. Ans. £8,179 15s. 6¾d.

(3) A boy earns 24s. 9d. for harvest work; his brother earns twice as much; his father earns as much as both of them together. What are the father's wages? Ans. £3 14s. 3d.

(4) Add together £6 14s. 9½d.; £7098 15s. 10¼d.; £929 13s. 6½d.; £5087 9s. 11¾d.; £86 10s. 5d.; £3801 16s. 6d. Ans. £17,011 1s. 1d.

STANDARD IV.

(1) Find the value of eight acres of land at 2s. 6d. the square yard. Ans. £4840.

(2) Divide ten thousand and fifty pounds two shillings and fivepence farthing by one hundred and ninety-nine. Ans. £50 10s. 0¾d.

(3) How many days, hours, etc., are there in four hundred and twenty-two thousand seconds? Ans. 4d. 21hr. 13m. 20s.

(4) A butcher used a lb. weight which was one ounce short weight, what did he gain by his dishonesty when he had sold 6 cwt. of meat at 8d a pound? Ans. £1 8s.

STANDARD V.

(1) Make out a bill for the following :—6 oz. Berlin wool at 9s. 4d. per lb.; 4 dozen crochet hooks at 5s. per gross; 3½ yds. of flannel at 1s. 8d. per yd.; and a dozen collars at 7½d. each. Ans. 18s. 6d.

(2) A lady uses 3 ozs. of wool in 7 hrs.; how much will she require for 7 days of eight hours each? Ans. 24 oz. (or) 1½ lbs.

(3) Find, by Practice, the amount of 793 railway fares at 6s. 9d. each. Ans. £267 12s. 9d.

(4) If 25 yds. of cloth cost £1 14s. 4½d., how many yds. can be purchased for £2 8s. 1½d.? Ans. 35 yds.

STANDARD VI.

(1) A bankrupt's debts amount to £3548 6s. 8d., what will his creditors lose if he pays 12s. 10½d. in the £? Ans. £1264 1s. 10½d.

(2) Find the value in £ s. d. of ·076 times £254⅓. Ans. £19 6s. $3\frac{6}{25}$d.

(3) Simplify $4\frac{2}{1\frac{1}{4}} - \frac{8\cdot5 + \cdot9}{2\frac{7}{15}} + \frac{1}{3}$ of 5. Ans. $1\frac{37}{42}$.

(4) A person sold ·15 of an estate to one person and $\frac{6}{17}$ of the remainder to another. How much of the estate had he left? Ans. ·6 or $\frac{3}{5}$.

(5) If the wages of 8 men for 13 weeks be £132 12s. how many men can earn £102 in 20 weeks? Ans. 4 men.

History.

STANDARD IV.

(1) What general invaded this country about 50 years before the birth of Christ?
(2) What were the Druids? What island was sacred to them?
(3) What people invaded this country about the year 450?
(4) From what country did this people come?
(5) Name one of our modern counties which formed part of East Anglia?
(6) Name a king who lived in the 9th century, and give the date of his accession?
(7) What people gave the Saxons a great deal of trouble in the 9th century, and what country did they come from?
(8) To what nation did King Arthur belong?
(9) What great man brought Christianity in among the Anglo-Saxons and who sent him?
(10) Who was the first of our kings that fitted out a fleet?
(11) Which of the Saxon kings quarrelled with the Abbot of Glastonbury? Name this abbot.
(12) Who divided the kingdom with Edmund Ironside?
(13) How many years did Edward the Confessor reign?
(14) Who became king on Edward the Confessor's death?
(15) Name Edward the Confessor's father-in-law.

STANDARD V.

(1) What king was deposed in the year 1483.
(2) In whose reign did the persecution of the Lollards begin?
(3) What relation was Edward IV. to Richard III.?
(4) Which of our kings married a French princess in the year 1420?
(5) In what year did Henry IV. die, and how many years did he reign?
(6) What king did penance for a murder in the year 1173, and whom had he murdered?
(7) What class of people were the Constitutions of Clarendon intended to keep in order?
(8) With whom had Archbishop Anselm so great a quarrel?
(9) What did William I. do in order to make people go to bed early?
(10) When Richard I. died, who ought to have had the crown? Whose grandchild was this person?
(11) Two kings were on the throne during the year 1327. Name these kings.
(12) What great man brought about the first real English Parliament? In whose reign was this?
(13) In what century, and by which of our kings, was Ireland conquered?
(14) What did Edward I. try to do, which his people would not allow?

STANDARD VI.

(1) What sovereign died in the year 1694?
(2) In what year did George III. become king?
(3) Whom did the 'Jacobites' fight for? In what year did their second great rebellion take place?
(4) Who was on the throne in the year 1709?
(5) What great battle was fought in 1798?
(6) What country became completely united to England in the 1st year of the 19th century?
(7) In what century was the Battle of Worcester fought? Who was defeated there?
(8) In the great Civil War of Charles I.'s reign, what names were given to (*a*) his followers, (*b*) the followers of the Parliament?
(9.) Who ruled England from 1653 to 1658, and what was his title?
(10) What famous trial took place in the last year of James II.'s reign?
(11) Give the date of the Battle of Naseby, and say who won it.
(12) What famous Lord Chancellor was put to death by Henry VIII.?
(13) Henry VIII.'s first wife was a widow. Name her first husband.
(14) Name Queen Elizabeth's chief advisers.
(15) Between whom and in what year was the battle of the Spurs fought?

Geography.

STANDARD IV.

(1) What divides Ireland from the southern parts of South Wales?
(2) To what hills does Ingleborough belong?
(3) What headland lies on the north-east side of the Minch?
(4) What is Connaught? In what part of the country is it?
(5) Name an important town in South Africa belonging to England.
(6) Name any county which is near the Knockmealdown mountains.
(7) What capital city lies near the Firth of Forth?
(8) Near what continent, and off which coast of it is Trinidad?
(9) Name the most northerly town in England.
(10) With what salt water is Dublin Bay connected? What river flows into this Bay?
(11) Name the most important British possession in the Western hemisphere.
(12) What lands are divided from one another by the Minch?
(13) If a ship were caught in a storm off the north-west coast of Clare, what bay would she most likely make for?
(14) What is Brighton, and in what county is it?
(15) What is Omagh, and in what county is it?

STANDARD V.

(1) Name a country of Northern Europe, and its capital.
(2) Name two towns near that coast of Great Britain which lies opposite to the west coast of Europe.
(3) In what direction does Stockholm lie from London?
(4) What is that part of Italy called through which the river Po flows.
(5) Of what country is Saxony a part?
(6) What town in Spain belongs to England? What continent is only a few miles from this town?
(7) In which of the European countries does the sun rise earliest?

(8) How many Zones are there? In which of these does the greater part of Europe lie?

(9) If a ship sails out of North Latitude into South Latitude, what line must she cross?

(10) In what country is the Zuyder Zee?

(11) Name a large island in the Mediterranean, and a volcano in it.

(12) In what country is the Arno? Name a city on its banks.

(13) Name the narrow piece of land which joins the Crimea to Russia.

(14) What two bodies of water are separated by the Scandinavian Peninsula?

(15) Name a large island in the Mediterranean belonging to France.

STANDARD VI.

(1) How many Zones are there? In which of these do we live?

(2) In which Hemisphere is the 'New World'?

(3) Of what does the 'New World' consist? What ocean washes it on the east?

(4) Name a country whose *western* shores are washed by the North Sea.

(5) What is Tasmania? Where is it?

(6) Near what continent are the West Indies?

(7) What connects North and South America? What water lies on the west of this?

(8) What sea lies between Suez and Aden?

(9) Name a country on the south side of the Mediterranean Sea.

(10) Name the most southerly point of America, and say on what island this is?

(11) If I want to go by water from Quebec to the sea, what river must I go down?

(12) What name is given to the region near the equator? Name a country in this region.

(13) What desert lies in Africa? What name is given to a fertile spot in a desert?

(14) What water lies between Turkestan and Mount Caucasus?

(15) Where is Popocatapetl? What is it?

—o—

Coming Examinations;

Their Dates and Special Subjects.

I.—Certificate Examination: Monday, Dec. 11, 1882.

MALE CANDIDATES.

Reading.—*First Year:* Goldsmith's 'Traveller' and 'Deserted Village,' Milton's 'Comus,' and Lamb's 'Tales from Shakspere.'
Second Year: Shakspere's 'Richard II.' and 'Tempest,' and from a Newspaper.

Grammar, etc.—*First Year:* Byron's 'Childe Harold's Pilgrimage,' Canto IV., Stanzas 1—48, and 140—end.
Second Year: Shakspere's 'Macbeth,' and Bacon's 'Essays,' 1—26.

Geography.—*First Year:* Europe (with G. Britain), Hindostan, Australia, N. Zealand, Canada, and S. African Colonies.

History.—*Second Year:* Special Period, from 1715—1837.

Languages.—*For* 1882: Cæsar, 'De Bello Gallico,' Book II., Virgil 'Æneid,' Book VI., Xenophon 'Anabasis,' Book II., Euripides, 'Medea,' Saintine's 'Picciola,' Book I., Moliere's 'L'Avare,' or 'Racine's 'Athalie,' Goethe's 'Italian Journey,' and Schiller's 'Maria Stuart.'

For 1883: Cæsar, 'De Bello Gallico,' Book III., Virgil 'Æneid,' Book VI., Xenophon, 'Anabasis,' Book III., Euripides, 'Medea,' Bonnechose's 'Lazare Hoche,' Moliere's 'L'Avare,' Goethe's 'Italian Journey,' and Schiller's 'Maria Stuart.'

FEMALE CANDIDATES.

Reading and Grammar, etc.—*First Year:* Byron's 'Childe Harold's Pilgrimage,' Canto IV., Stanzas 1—48 and 140—end.

Second Year: Shakspere, 'Macbeth.'

Geography.—Same as Male Candidaes.

History.—*Second Year:* The Tudor Period, or same as Males.

Languages.—Same as for Males, omitting *Greek*.

II. London University Matriculation.—The Third Monday in June, 1882.

Latin: Livy, Book II.
Greek: Homer, Iliad, Book XVIII.

III. The same Examination.—The Second Monday in January, 1883.

Latin: Cæsar, Gallic War, Books I. and II.
Greek: Xenophon, Anabasis, Book IV.

IV. The same Examination.—The Third Monday in June, 1883.

Latin: Ovid, Metamorphoses, Book II., and Epistolæ ex Ponto, Book I.
Greek: Homer, Iliad, Book VI.

V. The Oxford Local Examination.—Monday, June 5, 1882.

JUNIORS.

English: Goldsmith's 'Deserted Village,' Shakspere's 'King Lear.'

Scripture: Kings II., and Gospel according to St. John.

Geography: Map of England and Wales, Ireland, Spain and Portugal, India, or Australia.

History: Reign of Queen Anne.

Latin: Sallust (Jugurtha), and Virgil (Æneid, Book X.)

Greek: Xenophon (Anabasis, Book I.), and Homer (Odyssey, I.)

French: Bonnechose's 'Lazare Hoche.'

German: Lessing's 'Minna von Barnhelm' (Acts i., ii., iii.)

SENIORS.

English: Shakspere's King Lear, and Addison (Clarendon Press Selection), Sections IV., V., and VI., pp. 123—394.

Scripture: Kings II., Gospel according to St. John, and Acts of the Apostles.

Geography: Map of England and Wales, Ireland Spain and Portugal, India, Australia, or Africa.

English History and Literature: From the Revolution of 1688 to the death of Queen Anne.

Latin: Livy (Book I.), and Virgil (Æneid, IV.)

Greek: Herodotus, VIII., and Sophocles (Antigone).

VI. The Cambridge Local Examination.—Monday, December 11, 1882.

JUNIORS.

Religious Knowledge: Kings II., St. Mark's Gospel, Corinthians II.

English: Shakspere, Richard II. (Clar. Press Series).

English History: The Tudor Period.

Geography: Europe, Africa, Great Britain, and her dependencies.

Latin: Virgil, Æneid II. (Pitt Press Texts), and Cæsar, De Bello Gallico, III. (Pitt Press Texts).

Greek: Xenophon, Anabasis IV. (Pitt Press Texts), Euripides, Heracleidæ (Pitt Press Texts).

French: Madame de Stael, Le Directoire (Pitt Press Texts).

German: Uhland, Ernst, Herzog von Schwaben (Pitt Press Texts).

SENIORS.

Religious Knowledge: Kings II., St. Mark's Gospel, Corinthians II., Offices for Holy Baptism, Confirmation, and Holy Communion, Paley's Horæ Paulinæ (the Introduction and the Sections from the Epistle to the Ephesians to the end).

English: Shakspere, Richard II. (Clar. Press Series).

English History and Literature: The Tudor Period.

Geography: Europe and Africa.

Latin: Livy, Book XXI., and Virgil, Æneid II. (Pitt Press Texts).

Greek: Plato, Apology, and Euripides, Heracleidæ, (Pitt Press Texts).

French: Madame de Stael, Le Directoire, (Pitt Press Texts), and Moliere, Le Misanthrope.

German: Uhland, Ernst, Herzog von Schwaben, and Freytag, Der Staat Friedrichs des Grossen (Pitt Press Texts).

VII. Oxford Local Examinations for Women over 18 years of age.

First Examination.—June 5, 1882, and Dec. 11, 1882.

Latin: Cæsar (Bell. Gall. I., II.) and Virgil (Æneid III.)

Greek: Æschylus (Prometheus Vinctus), and Plato (Apologia).

Second Examination, Part I.—The Pass Examination.

Latin: Cicero (De Senectute, De Amicitia, and Pro Roscio), Horace, Epistles, I.

Greek: Thucydides, IV., and Sophocles (Antigone).

Grecian History: from B.C. 510 to the death of Alexander the Great, with accurate knowledge of one of the following periods: (1) from the outbreak of the Peloponnesian War to the Peace of Antalcidas; (2) from the accession of Philip of Macedon to the death of Alexander.

Roman History: from the beginning of the first Punic War to the accession of Nerva, with accurate knowledge of one of the following periods: (1) from the beginning of the second Punic War to the destruction of Carthage; (2) from the death of Sulla to the death of Augustus.

Modern History: from the accession of Henry II. to the Revolution of 1688, with an accurate knowledge of one of the following periods; (1) The Thirty Years' War; (2) the Reign of Louis XIV.; (3) from the accession of Charles I. to the Revolution of 1688.

Part II. Examination for Honours.

In this Examination the range of subjects, and the number of selected periods and books are so very large, that it would be almost impossible to give a reliable abridgment in the space we have to spare. We must therefore refer those of our readers who are interested in the subject, to the Syllabus.

VIII. College of Preceptors. Examination for Certificates.—June 13, and December 5, 1882.

FIRST CLASS.

English History and Literature: (1) *Midsummer:* from the accession of James II. to the death of Queen Anne: (2) *Christmas:* from the accession of Richard III. to the death of Elizabeth.

Latin: any one of Cæsar, 'Bell. Gall. I. and II.', or 'IV. and V.'; Sallust, 'Catiline'; Virgil, 'Æneid,' one *of the first three books:* Cicero, 'De Senectute'; and Horace, 'Odes,' Lib. I. or III.

Greek: any one of Xenophon, 'Anab. Lib. I.'; 'St. Luke's Gospel'; Homer, 'Iliad,' Book I.

Scripture History: (1) *Midsummer:* Kings II.; St. John's Gospel; the Acts. (2) *Christmas:* Kings II.; St. Mark's Gospel; the Acts.

SECOND CLASS.

Latin: Cæsar, 'Bell. Gall.' Lib. I. or II. or in *one* of the first two books of Virgil's 'Æneid.'

Scripture History: same as *First Class*, omitting 'the Acts.'

THIRD CLASS.

Latin: Cæsar, 'Bell. Gall.' Lib. I., Cap. 1—29, or Phædrus, Lib. I. and II.

Scripture History: same as *Second Class.*

ANSWERS TO
Pupil Teachers' Examination Paper.
FEBRUARY 25TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. 1 cwt. 11 lbs. 5 oz. at 3s. 10½d. per oz.

1 cwt. 11 lbs. 5 oz. = 1973 oz.

	£	s.	d.
Value of whole at £1 per oz. =	1973	0	0
,, ,, 2s. 6d. = ⅛ val. at £1 =	246	12	6
,, ,, 1s. 3d. = ½ ,, 2s. 6d. =	123	6	3
,, ,, 1½d. = 1/10 ,, 1s. 3d. =	12	6	7½
,, ,, ¼d. = ⅙ ,, 1½d. =	2	1	1½
,, ,, 3s. 10¾d. per oz. =	384	6	5¼

2. If 15½ lbs. of tea cost £2 14s. 3d. what will 6 boxes, each containing 1¼ cwt., cost?

1¼ cwt. × 6 = 9 cwt. = 1008 lbs.

15½ lbs. : 1008 lbs. :: £2 14s. 3d. : cost required.

$$\frac{54\frac{1}{2}\text{s.} \times 2016}{31} = \frac{217 \times 2016}{31 \times 4}\text{s.} =$$

$$£\frac{7 \times 504}{20} = £176\ 8\text{s.}$$ Ans.

3. 99 acres 3 roods 30 poles 5 square yards at £100 an acre.

	£	s.	d.
Value of 1 ac. =	100	0	0
,, 99 ac. =	9900	0	0
,, 2 ro. = ½ val. of 1 ac. =	50	0	0
,, 1 ,, = ½ ,, 2 ro. =	25	0	0
,, 20 po. = ⅘ ,, 1 ro. =	12	10	0
,, 10 ,, = ½ ,, 20 po. =	6	5	0
,, 5 yds. = 1/40 ,, 1 ro. =	0	2	0 99/121
,, 99 ac. 3 ro., etc. =	9993	17	0 1/121

4. If 6 men can do a piece of work in 5 days, working 8 hours a day, in how many days could 3 men do the same job, working 10 hours a day?

3 men : 6 men
10 ho : 8 ho. } :: 5 days : time required.

$$\frac{5 \text{ days} \times 6 \times 8}{3 \times 10} = 8 \text{ days.}$$

FEMALES.

1. Find the value of 7059 articles at £144 13s. 10½d. each.

	£	s.	d.
Total value at £1 each =	7,059	0	0
			144
,, £144 ,, =	1,016,496	0	0
,, 10s. = ½ val. at £1 =	3,529	10	0
,, 2s. 6d. = ¼ ,, 10s. =	882	7	6
,, 1s. 3d. = ½ ,, 2s. 6d. =	441	3	9
,, 1½d. = 1/12 ,, 1s. 3d. =	36	15	3¾
,, £144 13s. 10½d. =	1,021,385	16	6¾

2. What is the cost of 20 sq. yds. 5 sq. ft. 48 sq. in. at £3 8s. 0¾d. per sq. yd.?

	£	s.	d.
Value of 1 sq. yd. =	3	8	0¾
			20
,, 20 ,, =	68	1	3
,, 3 ft. = ⅓ of 1 sq. yd. =	1	2	8½
,, 1 ,, = ⅓ of 3 ft. =		7	6½
,, 1 ,, = 1/9 ,, =		7	6½
,, 48 in. = 1/9 ,, =		2	6½
Total val. of 20 sq. yds. 5 ft. 48 in. =	£70	1	7

3. Find the cost of 7985⅞ at £8 19s. 4½d. each.

		£	s.	d.
Value of 7985 at £9 each	=	71,865	0	0
Subtract ,, 7½d. = ⅛ of £1	=	249	10	7½
		71,615	9	4½
Add ⅞ of £8 19s. 4½d.	=	7	13	9
		71,623	3	1½

4. Make out and receipt the following bill :—11 lbs. at 4½d. per lb., 15 oz. at 2s. 2½d. per oz., 3¾ lbs. at 16d. per lb., 40 lbs. at 7½d. each, 3½ dozen at 13d. a doz., 4½ yds. at 18d. a yd., 2½ doz. at 3 for twopence.

11 lbs. at 4½d.	=	0	4	1½
15 oz. ,, 2s. 2½d.	=	1	13	1½
3¾ lbs. ,, 1s. 4d.	=	0	5	0
40 ,, ,, 0s. 7½d.	=	1	5	10
3½ doz. ,, 1s. 1d.	=	0	3	9½
4½ yds. ,, 1s. 6d.	=	0	6	4½
2½ doz. ,, 3 for 2d.	=	0	1	8
		3	19	11

Received payment

£3 : 19 : 11
Pupil Teacher
25/2/82.

Note.—This Bill requires a stamp.

Grammar.

1. Parse all the nouns and verbs in the following :—

'Shame knew him not, he dreaded no disgrace,
Truth, simple truth, was written in his face ;
Yet, while the serious thought his soul approved,
Cheerful he seemed, and gentleness he loved.'—CRABBE.

shame—abstr. noun, neut., sing, nom., subj. of *knew*.
knew—trans. verb, irreg. *know, knew, known*, indic., past indef., 3rd pers. sing. agr. with *shame*.
dreaded—trans. verb, reg., indic., past indef., 3rd pers. sing. agr. with *he*.
disgrace—abstr. noun, neut., sing., obj., gov. by *dreaded*.
truth—abstr. noun, neut., sing., nom., subj. of *was*.
truth—repeated for emphasis—attributive to the first *truth*.
was—subst. verb, *am, was, been*, indic., past indef., 3rd pers. sing., agr. with *truth*, and forming with complete part.
written—the same tense, etc., of the passive voice of the irreg. verb *write, wrote, written*.
face—com. noun, neut., sing., obj., gov. by prep. *in*.
thought—abstr. noun, neut., sin., obj., gov. by *approved* (*of*).
soul—abstr. noun, neut , sing., nom., subj. of *approved*.
approved (of)—trans. verb. reg., indic., past indef., 3rd. pers. sing., agr. with *soul*.
seemed—intrans. verb, reg., indic., past indef., 3rd pers., sing., agr. with *he*.
gentleness—abstr. noun, neut., sing., obj., gov. by *loved*.
loved—trans. verb, reg., indic., past indef. 3rd pers., sing., agr. with *he*.

2. What are the three main tenses of the verb, and what are the forms of each of these main tenses? Give examples.

The three main tenses of the English verb are the *past*, *present*, and *future*. The following examples show the forms of each of these :—

I was loving.....Past imperfect (or progressive).
I had loved ..... ,, perfect.
I loved ..... ,, indefinite.
I am loving .....Present imperfect.
I have loved ..... ,, perfect.
I love ..... ,, indefinite.
I shall be writing ..... Future imperfect.
I shall have written ..... ,, perfect.
I shall write..... ,, indefinite.

3. Give examples to show that the adjective does not always precede the noun it qualifies.

The adjective is placed after the noun in the following :—

A servant *faithful* to his master.
A king *wise, valiant*, and *good*.
John is twenty years *old*.
'The way was long, the wind was cold,
The minstrel was infirm and old.'

Geography.

Answer *two questions*.

1. Describe minutely the course of a ship sailing along the coast from Greenock to Aberdeen.

Starting from the busy seaport of Greenock, and sailing south, we pass the island of Bute, and meet with *Loch Fyne* stretching far into Argyleshire. Then passing between *Bute* and *Arran*, we pass through *Kilbrannan Sound*, and along the peninsula of *Cantire*, rounding which we go north to the fertile island of *Islay*. Passing *Jura* we reach *Oban*, the chief packet-station in the West Highlands, and a great centre for tourists. Skirting the large island of *Mull*, we come to *Iona*, with the remains of a monastery, where many of the Scottish kings are buried. A little to the north is *Staffa*, with Fingal's Cave. We next come to *Skye*, with *Portree*, its principal town. Continuing up the coast of Ross through the *Minch*, with *Lewis* on our left, we reach the lofty promontory of *Cape Wrath*, where we turn eastwards along the coast of *Sutherland* : past *Loch Eriboll* and the *Kyle of Tongue*, we come to *Thurso*, in *Caithness*, with a good harbour. Rounding *Dunnet Head*, we come to *Duncansbay Head* on the *Pentland Frith*, the tides of which are very violent. Turning south, we come to *Wick*, the chief station for the herring-fishery. Passing *Dornoch* and *Tain*, and rounding *Tarbetness*, we come to *Cromarty*, birth-place of Hugh Miller; pass the mouths of *Cromarty* and *Beauly Friths*, with *Dingwall* on the first and *Inverness* on the second. Passing *Nairn*, we continue east round *Burgh Head*, and reach *Fraserburgh*. Further south, on the coast of *Aberdeen*, we find *Peterhead*, an important whale-fishing town; pass the *Bullers of Buchan*, and reach our destination, *Aberdeen*, with extensive manufactures and commerce.

2. Name in some regular order, but in any order you please, the counties of England which do *not* border on the sea, and describe fully the physical features of one of them.

Derby, Nottingham, Leicester, Rutland, Northampton Huntingdon, Cambridge, Hertford, Middlesex, Surrey, Berkshire, Wiltshire, Hereford, Salop, Stafford, Worcester, Warwick, Oxford, Buckingham, Bedford.

The physical features of Derby.—The southern parts have an easy ascent to the north-western portion, which comprehends one of the most elevated and rugged districts of England. This part of the county, known as the *Peak*, is occupied by a part of the Pennine chain, which separates the waters flowing east from those flowing west. The Peak contains four summits above 1700 feet high *Lord's Seat, Axe Edge Hill, Blakelow Stones, Kinders-cout*. This ridge divides the basin of the Mersey from that of the Trent ; an offshoot from it divides the basin of the Derwent from that of the Dove, and another ridge separates the basin of the Derwent from those of the Don and the Rother. These highlands are intersected by narrow valleys and dales of great beauty, the broadest and deepest being in the higher parts of the Peak. The faces of the rocks rise up almost perpendicularly from the sides of the valleys. *Matlock, High Tor*, and other rocks skirting parts of the valley of the Dove, are of this precipitous character.

3. A traveller in Ireland went to see the Wicklow Hills, the Lakes of Killarney, and the Giant's Causeway. Write a short letter giving an account of what he saw.

London, 25th Feb., 1882.

Dear Sir,—The eastern flank of the Wicklow Mountains presents a varied aspect, being worn into deep glens and dells, lined with precipices occupied by small lakes, whence begin those narrow valleys whose general direction to the S.E. is distinguished by the most beautiful scenery. The chief of these are *Glen-malur, Glen of the Downs, Devil's Glen*, and the *Vale of Avoca* (the scene of Moore's 'Meeting of the Waters').

The western side is less varied, the glens and valleys being more rounded and expanded. The rivers rising in these have a general direction to the N.W. The general elevation of the Wicklow Mountains is from one to two thousand feet. *Lugnaquilla* is the highest point; and I must not omit to mention that the 'shillelah' derives its name from a wood near Arklow.

The Killarney Lakes, in Kerry, are three in number—the Upper, Middle, and Lower Lakes—all of which communicate with each other. They are extremely beautiful in scenery, and lie at the foot of the highest mountains in Ireland, the *Macgillicuddy Reeks*.

The Giant's Causeway lies on the north coast of Antrim, and the Irish name for it means the 'stepping-stones of the Fomorians' (a race of sea-rovers). It is composed of at least 30 000

ofty columns in regular order, which run out a great way into the sea, and are undoubtedly the finest specimens of columnar basalt in Europe.—I am, dear sir, your obedient servant,

PUPIL TEACHER.

To H. M. Inspector.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

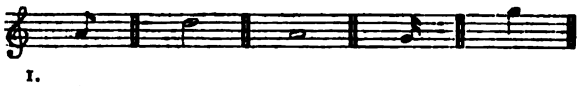
Write in large hand as a specimen of copy-setting, the word *Rhapsody*.

Write in small hand, as a specimen of copy-setting—

Nelson has been justly called 'the greatest seaman of all time.'

Music.

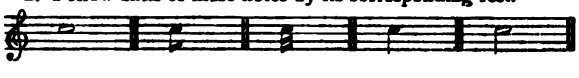
A quarter of an hour allowed for this Paper.

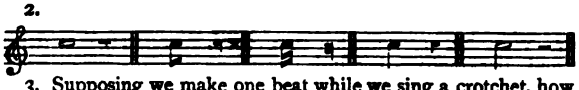
1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).

1.

A D A G G

Quaver. Minim. Semibreve. Semiquaver. Crotchet.

2. Follow each of these notes by its corresponding rest.



2.

3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a semibreve?

3. If we make one beat while we sing a crotchet, we shall make *four* beats while we sing a semibreve, because a semibreve is equal in duration to four crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Reduce 1s. 9½d. to the decimal (*a.*) of 5s., and (*b.*) of £$\frac{111}{320}$.

(*a.*) $\frac{\text{1s. } 9\frac{1}{2}\text{d.}}{5\text{s.}} = \frac{\text{}^{\circ}\text{a.s.}}{240}\text{far.} = \frac{17}{48} = \frac{4{\cdot}25}{12} = {\cdot}35416$

(*b.*) $\frac{\text{1s. } 9\frac{1}{2}\text{d.}}{£\frac{111}{320}} = \frac{85\text{ far.}}{\frac{111\times960}{320}\text{ far.}} = \frac{85}{333} = \frac{255}{999} = {\cdot}255$

2. If a boy requires ⅔ as much meat as a man, and ⅐ of a sheep are enough for 10 men and 6 boys (*a.*), for how many *men*, and (*b.*) how many *boys* would a whole sheep serve?

man's share = 3 ∴ 10 men require 30 shares
boy's " = 2 ∴ 6 boys " 12 " } = 42 shares.

$\frac{30}{42}$ of $\frac{7}{8} = \frac{30\times7}{42\times8} = \frac{5}{8}$ ∴ 5 : 8 :: 10 men : 16 men.

$\frac{12}{42}$ of $\frac{7}{8} = \frac{12\times7}{42\times8} = \frac{2}{8}$ ∴ 2 : 8 :: 6 boys : 24 boys. Ans.

3. Find, and state in decimals, and in vulgar fractions, the difference between—

(*a.*) (·39 × 11 × ·007) ÷ 1·8; and
(*b.*) (⅜ of 83860) ÷ 270000

(*a.*) $\frac{{\cdot}39\times11\times{\cdot}007}{1{\cdot}8} = \frac{4{\cdot}4\times{\cdot}07}{18} = \frac{154}{9000}$ or ·0171

(*b.*) $\frac{\frac{3}{7}\text{ of }83860}{270000} = \frac{3\times11980}{270000} = \frac{1198}{9000}$ or ·1331

∴ (*b.*) is greater than (*a.*) by $\frac{29}{250}$ or ·116. Ans.

4. If a speculator purchased two million articles at £1 15s. 2d. per score, and sold them at £1 1s. 1½d. per dozen, what amount of money would he gain or lose?

(*a.*) Selling price of each in pence = $\frac{253\frac{1}{2}\text{d.}}{12} = 21\frac{8}{48}$ or $21\frac{4}{96}$

(*b.*) buying " " " = $\frac{42}{2}\frac{2}{0} = 21\frac{1}{10}$ or $21\frac{48}{480}$

∴ gain on each in pence = $\frac{1}{480}$

∴ total money gained = $\frac{1}{480}$d. × 2,000,000
= $\frac{2000000}{480}$d. = 8333⅓d. = £34 14s. 5⅓d

FEMALES.

1. A person who owes £9280 17s. 6d. can only pay £4872 9s. 2½d. How much is this in the pound?

£9280 17s. 6d. = £9280½

∴ £9280½ : £1 :: £4872 9s. 2½d. : composition per £.

$\frac{974749\text{s. } 2\frac{1}{2}\text{d.} \times 8}{74247} = \frac{7795931}{74247}\text{s.} = \frac{1559187\text{ s.}}{74247\times2} = \frac{21}{2}\text{s.} = 10\text{s. } 6\text{d}$

2. A tree casts a shadow 16 ft. 6 in. long, while the shadow of a neighbouring tower is 49 ft. 6 in. If the height of the tower be 94 ft. 6 in., what is the height of the tree?

49 ft. 6 in. : 16 ft. 6 in. :: 94 ft. 6 in. : height of tree.

$\frac{189\times33}{2\times99} = 31\text{ ft. } 6\text{ in.}$ Ans.

3. If 120 yds. of gas-piping are laid down by 5 men in 8 days, how many men will be required to lay down 4 times the quantity of piping in one-half the time?

1 quantity : 4 quantities
1 time : 2 times } ∴ 5 men : no. required.

$\frac{5\text{ men}\times4\times2}{1\times1} = 40\text{ men.}$ Ans.

4. If I borrow £300 for 8 months when money is worth 5 per cent., how much ought I to lend in return for 15 months when money is worth 3 per cent.?

15 mos. : 8 mos.
3 p. c. : 5 p. c. } :: £300 : sum required.

$\frac{£300\times8\times5}{15\times3} = \frac{£800}{3} = £266\text{ 13s. } 4\text{d.}$ Ans.

Grammar.

1. Point out and parse the pronouns in the following:—

'Ask for what end the heavenly bodies shine,
Earth for whose use? Pride answers, "'Tis (it is) for mine:
For me kind nature wakes her genial power,
Suckles each herb, and spreads out every flower."'

Why is 'mine' used rather than 'my' in the second line? When would 'my' be used rather than 'mine'?

PARSING OF PRONOUNS.

Whose—simple relative, com., referring to (*any one*), sing., pos., attributive to *use*.

it—pers. pron., 3rd pers., neut. referring to the interrogative sentence, sing. nom., subj. of *is*.

mine—pers. pron., 1st pers., mas., referring to 'pride' personified, sing., poss., predicative of (*end* or *use*).

me—pers. pron., 1st pers., mas., referring to 'pride,' sing., obj., gov. by *for*.

her—pers. pron., 3rd pers., fem., referring to 'nature personified, sing., poss., attributive to *power*.

'Mine' is used instead of 'my' in the second line because the noun to which it relates is understood. 'My' is always used when the noun is expressed. 'Mine' is often used in poetry for 'my' before a vowel or *h* mute.

2. Distinguish between the gerund and the participle of a verb; and show why the one is said to be a verbal noun and the other a verbal adjective. Give examples of each.

The *Gerund* is a substantive formed from a verb, having the form of the imperfect participle, and when derived from a transitive verb has the governing power of the verb. It is used as the subject or object of verbs, and may be governed by prepositions, as:—*Hunting* the fox is an English sport; he likes *hunting* the hare; I am fond of *reading*. *Participles*, on the other hand, qualify a noun either predicatively or attributively, but are never used as subjects or objects of verbs, or after prepositions, as:—A *rolling* stone; a *hunted* hare; a *glittering* stream.

3. Name all the parts of speech modified by adverbs. Give examples.

Adverbs modify (1) verbs, as 'Stand *here*'; 'Live *honestly*'; 'Run *now*.' (2) Adjectives, as, 'The story is *too* long'; 'That is *quite* right.' (3) Adverbs, as, 'You write *very* badly'; 'He ran exceedingly well.'

Geography.

Answer *either* Q. 1 *or* Q. 3, *not both*.

1. Name in some regular order, but in any order you please, the counties of England which do *not* border on the sea; and describe the physical features of one of them.

(See answer to No. 3 Candidates' Geography.)

2. Draw a map of the country on each side of the Pyrenees, showing the basins of the Garonne and the Ebro, and the principal towns included in these basins.

3. Describe fully the kingdom of Greece, and the islands which lie near its coasts.

The kingdom of Greece is of an extremely irregular form, being broken up by straits and deep inlets into a series of peninsulas and islands. Surrounded by the sea on three sides, and lying within easy access of three continents, Greece was without exception the most favoured of all ancient countries. In proportion to its area, the coast-line greatly exceeds that of any other country. The surface is very mountainous, and the centre of the Morea is an elevated plateau.

The area of Greece is two-thirds the size of Scotland, and the population about one and a half millions. The Conference in Berlin, 1880, fixed a new boundary on the north. In 1845, the whole country was divided into thirteen *nomos* four are included in *Hellas* or *Livadia*, six in *Morea* or *Peloponnesus*, and three in *Ionian Islands*.

The climate is generally mild, in the parts exposed to the sea equable and genial, but in the mountainous regions of the interior sometimes very cold. The summer is very dry, but rain falls in great quantities after harvest.

Agriculture is in a very backward state, but the Corinthian grape or currant is greatly exported, and among other objects of cultivation we must include as important the olive and mulberry.

The manufactures are extremely limited, but with all other branches of industry in Greece are increasing.

Much of the trade carried on by the Greeks is merely coasting; but the foreign trade is now considerable, a large portion of the latter being the importation of the cotton and woollen manufactures of Britain and Germany into Greece, Turkey, and Persia. The chief ports are *Corfu*, *New Syra*, *Piræus*, and *Patras*.

The principal exports are currants and olive oil.

The greatest hindrance to the development of Greece at present is the want of good roads, and the only railway as yet, is one about seven miles in length from Athens to its port Piræus. Chief towns: Athens, Lepanto, Livadia, Napoli di Romania, Argos, Corinth, Arcadia, Navarino, Corfu, Zante.

The educational system is among the best in the world.

The government is a constitutional monarchy; the executive being vested in the king and his responsible ministers, assisted by a council of state.

The Islands: The islands are deficient in wood, but are rich in wines and fruits. Eubœa or Negropont is a narrow island, the largest belonging to Greece, and is so near the mainland that in one part it is joined to it by a bridge. Its capital, Negropont, is a very ancient town, and was of great military importance. *Paros* is famous for its fine statuary marble of the purest white. *Antiparos* has a huge grotto of alabaster with many chambers and natural pillars. The *Ionian Islands* were under the protection of Britain, from 1815 till 1864, when they were re-united to Greece.

History.

1. Make a list showing the names and dates of our kings from 871 to 973.

		A.D.
Alfred	began to reign	871
Edward the Elder	,, ,,	901
Athelstan	,, ,,	925
Edmund	,, ,,	940
Edred	,, ,,	946
Edwy	,, ,,	955
Edgar	,, ,,	959
,,	crowned at Bath	973.

2. Write out the succession of our sovereigns from Edward the Confessor to Henry II., with dates.

		A.D.
Edward (Confessor)	began to reign	1042
Harold II.	,,	1066
William I.	,,	1066 (Dec. 25.)
William II.	,,	1087
Henry I.	,,	1100
Stephen	,,	1135
Henry II.	,,	1154.

3. What sovereigns have reigned over the United Kingdom since the beginning of the nineteenth century? Give dates.

At the beginning of the century, 1801, George III. was reigning,.....and he began to reign 1760

George IV.	,,	,,	1820
William IV.	,,	,,	1830
Victoria	,,	,,	1837.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word, *Rhapsody*.

Write in small hand, as a specimen of copy-setting, *Nelson has been justly called, 'The greatest seaman of all time.'*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

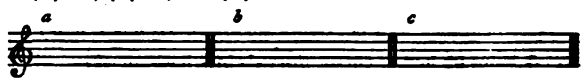
A quarter of an hour allowed for this Paper.

1. What is meant by a *sound*, what by a *tone*; and how does a sound differ from a tone?

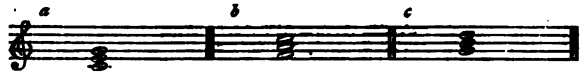
1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones. The natural scale has eight sounds, rising in successive steps by tones and semitones, the latter being found between the third and fourth, and seventh and eighth sounds.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) Do, (F) Fa, and (G) Sol.



2. A *triad* is the addition of its third and fifth to any given note.



3. How many tones and how many semitones are found in the diatonic scale, and what are the places in it of the latter?

3. In a diatonic scale are found five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. In a school of 570 boys, 90 per cent. are presented for examination. 500 pass in reading, 450 in writing, and 390 in

arithmetic. What is the percentage (to two places of decimals) of passes in each subject?

(*a*) 90 p. c. of 570 = $\frac{9}{10}$ of 570 = 513 presented for examination.

(*b*) $\frac{500}{513}$ pass in reading, *i.e.*, $\frac{500 \times 100}{513}$ p.c. = 97·46

(*c*) $\frac{450}{513}$,, ,, writing, *i.e.*, $\frac{450 \times 100}{513}$ p.c. = 87·72

(*d*) $\frac{390}{513}$,, ,, arith., *i.e.*, $\frac{390 \times 100}{513}$ p.c. = 74.20. Ans.

2. If a money-lender receive as interest per month $\frac{1}{10}$th of the sum advanced, what is his rate of interest per cent. per annum?

$\frac{1}{10}$ per month = $\frac{12}{10}$ of the sum for a year

$\frac{12}{10}$ of the whole = $\frac{12 \times 100}{70}$ p.c. = $17\frac{1}{7}$ per cent. Ans.

3. If 90 score of sheep and 15 pairs of coach-horses cost the same sum, viz. £4050,—reduce the price of a sheep to the decimal of the price of a coach-horse.

Price of 1800 sheep = price of 30 horses.

,, ,, 1 ,, = $\frac{30}{1800}$ or $\frac{1}{60}$ of the price of 1 horse

∴ Price of 1 sheep as the decimal of 1 horse = ·016. Ans.

4. What decimal of 1 lb. (Troy) is 1 grain?

24	1 grain
20	·0416 dwt.
12	·002083 oz.
	·00017361 lb. Ans.

FEMALES.

1. Reduce $\frac{2005}{16}\frac{3}{8}\frac{0}{3}\frac{1}{5}\frac{6}{2}$ to its lowest terms.

Dividing the terms by 23456 the G.C.M. and the lowest terms = $\frac{1}{7}\frac{1}{4}$. Ans.

2. Simplify $\frac{2\frac{2}{3}+\frac{2}{7}}{3\frac{1}{5}\ \ 7\frac{1}{2}} + 4\frac{5}{11} \times 2\frac{2}{4} + 1\frac{1}{3}$

$$\left\{\left(\tfrac{2}{3}\times\tfrac{5}{16}+\tfrac{15}{7}\times\tfrac{2}{15}+\tfrac{2}{7}\right)\div 1\tfrac{1}{3}\right\}+\left(\frac{47\times 11}{11\times 4}\right)+\tfrac{3}{4}=$$

$$\left\{\left(\tfrac{1}{8}+\tfrac{1}{7}\right)\times\tfrac{2}{4}\right\}+\frac{47+6}{4}=$$

$$\left(\frac{35+24}{42}\times\tfrac{2}{4}\right)+\tfrac{53}{4}=$$

$$\frac{59+742}{56}=\frac{801}{56}=14\tfrac{17}{56}. \text{ Ans.}$$

3. A can complete a piece of work in 12 days, working 8 hours a day; B can complete the same piece of work in 7 days, working 9 hours a day. How long will it take both of them to complete the work if they work together at it 6 hours a day?

A takes 96 hours, and ∴ does $\frac{1}{96}$ in 1 hour, or $\frac{1}{96}\times 6$

B ,, 63 ,, ∴ ,, $\frac{1}{63}$,, or $\frac{1}{63}\times 6$

∴ A and B working together do in one hour $\frac{1}{96}\times 6 + \frac{1}{63}\times 6$

They will therefore, working 6 hours a day, do the whole in

$$\frac{2016}{53\times 6} \text{ days} = 6\tfrac{18}{53} \text{ days. Ans.}$$

4. What fraction of a guinea, together with 4*s.* 6d., is equivalent to 15*s.*?

The fraction required = $\frac{15s.-4\frac{1}{2}s.}{21s.}=\frac{10\frac{1}{2}}{21}=\frac{21}{42}=\frac{1}{2}$. Ans.

Grammar.

1. 'A man who has been brought up among books and is able to talk of nothing else is a very indifferent companion, and is what we call a pedant. But, methinks, we should enlarge the title and give it to every one that does not know how to think out of his profession and particular way of life.'—ADDISON.

(*a*) Parse fully all the relative pronouns in the above.

(*b*) Show what part these relatives have in connecting the different sentences.

(*c*) Point out all the enlargements of the predicate that occur in the above passage.

(*a*) and (*b*) *Who*—simple relative pronoun., 3rd pers. sing., mas., referring to *man*, nom., subj. of *has been brought up*, connecting the subord. adj. sent., '*has been*,' etc., with '*man*' in the prin. sent., '*A man is a very indifferent companion.*'

what—rel. pron., with antecedent (*that?*) understood, 3rd pers. sing., neut., nom., after *is*, connecting the subord. adj. sent. '*we call a pedant*' with the prin. sent., *A man is (that).*'

that—simple rel. pron., 3rd pers. sing., mas., referring to *one*, nom., subj. of *does know*, connecting the pron. *one* in the prin. sent., '*we should give it to every one,*' with the subord. adj. sent., '*does not know,*' etc.

(*c*) The only enlargement of the predicate is '*among books.*'

2. Give examples of two complex sentences, one in which the principal is joined to the subordinate sentence by a conjunction, the other in which it is joined to it by a relative pronoun.

(1) Trees grow where our old home stood.
(2) The place, which knows us now, shall know us no more.

3. 'Conjunctions are frequently used in pairs.' Show this to be a true statement.

Both is used with *and*; *either* with *or*; *neither* with *nor*; *whether* with *or*; *though* with *yet*; *if* with *then*; as, '*Both* John *and* Henry are here'; '*Either* you *or* I must go,' etc.

Geography.

Answer *either* Q. 1 *or* Q. 3, *not both*.

1. Describe fully the kingdom of Greece, and the islands which lie near its coasts.

See answer to No. 3, First year, Geography,

2. Draw a map of Northern Hindostan, showing the basins of the Ganges and the Indus, and the chief towns which stand in those basins.

See any good atlas.

3. Say what you know about Agra, Algoa, Ascension, Assam, Auckland, Orange, Otago, Perth.

Agra is a city of the N.W. provinces of India, on the right bank of the Jumna, possessing the most superb mausoleum in the world.

Algoa is a bay E. of the Cape of Good Hope whose shores are among the most fertile and beautiful districts in South Africa.

Ascension is a small island in the South Atlantic, N.W. of St. Helena. Fresh water and vegetables are scarce, but the inhabitants are well supplied with turtlss and fish.

Assam is a province of British India in the presidency of Bengal. It is very fertile and is watered by the Brahmapootra and other rivers. The cultivation of the tea-plant is well attended to.

Auckland is a province of New Zealand comprising the half of North Island, and it is rich in minerals, and remarkable for hot springs and mud volcanoes. The chief town is Auckland.

Orange, a river of South Africa forming the boundary between the country of the Hottentots and Cape Colony, falls into the Atlantic after a course of nearly 1,000 miles. Its course near the sea hemmed in by steep mountains is interrupted by cataracts which are likely to prevent its utility as a commercial river.

Otago a province of New Zealand, was founded in 1848. The climate is very healthy, pasturage abundant, and European crops raised. Timber is abundant, and gold fields are all over the country. Dunedin is the capital.

Perth is the capital of West Australia on the Swan River, but otherwise a place of little importance.

SECOND PAPER.

One hour allowed for Females.
Two hours and a half allowed for Males.

1. What do you know of the House of Cerdic? Mention names and dates of the most famous princes of that house.

A Saxon chief named *Cerdic* landed in 495, and founded the kingdom of Wessex. This kingdom continued to be ruled by his descendants, who by their enterprise raised it above all the other kingdoms of the Heptarchy, till *Egbert* was able to call

himself *king of the English*, 827. The other most famous kings of the House of Cerdic are :—

Ethelwulf	who reigned	from 837
Alfred the Great	,,	871—901
Edward the Elder	,,	901—925
Edgar	,,	959—975
Ethelred the Unready	,,	979—1016
Edmund Ironside	,,	1016—
Edward the Confessor	,,	1042—1066

2. What king of Scotland was slain in Northumberland during the reign of William II.? Narrate the circumstances.

In 1091 William II. having repelled an invasion of the Scots made a peace with their king Malcolm, who renewed to Rufus the homage he had already paid to the Conqueror. Malcolm's next invasion in 1093 cost him his life, he being killed before Alnwick.

3. What occasioned the 'hundred years' war' between England and France?

On the death of Charles IV., in 1328, Edward III. had put in a claim to the crown of France in the right of his mother; but the French maintained that no right could pass through women, who, by a custom supposed to be founded on the ancient Salic Law, were shut out from the throne. Nothing came of this claim until Philip of Valois by encroaching in Aquitaine, and by supporting the Scots in their hostilities, roused Edward into setting it up again and entering upon the 'Hundred Years' War,' so called because, though there was not constant fighting, there was no lasting peace during that time.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Rhapsody*.

Write in small hand, as a specimen of copy-setting, *Nelson has been justly called 'The greatest seaman of all time.'*

Composition.

With full notes of a lesson on *Glass*.

NOTES 'ON GLASS.'

Objects to be shown to Class.—Pieces of as many kinds of glass as possible—emery powder—sand—potash—lime—saltpetre—flint—iron rust.

How glass is made.—Sand and soda or potashes, melted together in an earthenware pot at a very strong heat, to make common or window glass. For *Crown* glass some saltpetre and lime are added; for *Plate* glass saltpetre sometimes left out; these materials used in different proportions by different manufacturers.

How glass is shaped.—All materials being melted to a paste, an iron tube is put into it, and the lump which sticks to the end is blown into the shape of a bubble; part opposite the end of blow-pipe is opened, and by a quick, whirling motion the hole opens and the bubble becomes a round, flat sheet. Sometimes another plan is taken instead of the above; the molten glass is blown into the inside of a metal cylinder, and then, while still hot, cut and flattened down. (*Show with a piece of paper rolled into the form of cylinder.*)

Plate glass is made by pouring the molten mass on to a smooth metal table, and rolling it out evenly with a metal roller. It is then cooled very slowly to prevent its becoming brittle; ground with water and emery, and polished with water and iron-rust; finished by rubbing two plates together.

Uses.—Windows, roofs (description of Crystal Palace), bottles, glasses, decanters, spectacles, telescopes and microscopes (great care is taken in the making of lenses for these), mirrors (glass covered with an alloy of mercury and tin); church windows made of beautifully stained glass.

Euclid.

[All generally-understood abbreviations for *words* may be used.]

1. Write out the postulates. Which of them are required in the construction of the first proposition?

The postulates are :—

(1) Let it be granted that a straight line may be drawn from any one point to any other point.

(2) That a terminated straight line may be produced to any length in a straight line.

(3) And that a circle may be described from any centre at any distance from that centre.

In the first proposition the *third* postulate is required in describing the circles and the *first* in drawing the lines.

2. To bisect a given rectilineal angle, that is, to divide it into two equal parts.

See Prop. 9, Bk. I.

3. At a given point in a given straight line, to make a rectilineal angle equal to a given rectilineal angle.

See Prop. 23, Bk. I.

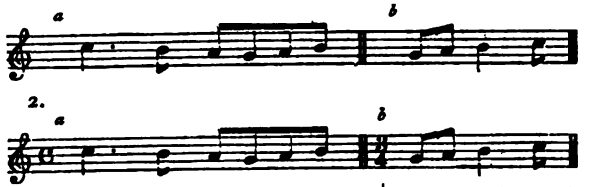
Music.

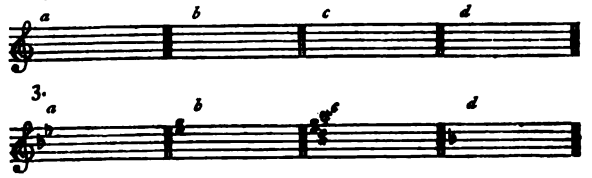
Quarter of an hour allowed.

1. Write, under each of the following intervals, its name (second, third, or other) and quality (major, perfect, or other).

1.

Perfect 5th. Major 2nd. Major 3rd. Imperfect 5th. Pluperfect 4th.

2. Place before *a* and *b* their time signatures.

3. Write in *a* the scale signature of B♭ (*Se*), in *b* that of G (*Sol*), in *c* that of D (*Re*), and in *d* that of F (*Fa*.)



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* **1st *May*, 1878; and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. What annual income will arise from the investment of £1800 in the 3¼ per Cents. when they stand at 87½?

£87½ bring £3¼
1 ,, £$\frac{26}{697}$
∴ £1800 ,, £$\frac{26 \times 1800}{697}$ = £$\frac{46800}{697}$
i.e., £67 2s. 10$\frac{113}{697}$d

2. In what time will £645·75 amount to £960·553125 at £4·125 per cent. per annum?

Interest = £960·553125 − £645·75 = £314·803125 = £$\frac{503685}{1600}$

∴ £4$\frac{1}{8}$: £$\frac{503685}{1600}$ } :: 1 year : time required.
£645$\frac{3}{4}$: £100
Or, £6600 : £$\frac{503685}{2583}$ } :: 1 year : time.
£400

$\frac{1 \text{ year} \times 503685 \times 400}{6600 \times 2583} = \frac{1 \text{ year} \times 195 \times 10}{165 \times 1} = \frac{130}{11} = 11\frac{9}{11}$ yr.

3. At what price must an article have been bought, in order that, being sold for £3·525, 13 per cent. may be cleared? To clear 13 per cent. the article must have been sold for 1$\frac{13}{100}$ of cost price.

∴ the buying price must be—

$$\frac{£3{\cdot}525 \times 100}{113} = \frac{£352\ 10s.}{113} = £3\ 2s.\ 4\tfrac{76}{113}d.\ \text{Ans.}$$

4. I borrow £130 on the 5th March and pay back £132 10s. 6d. on the 18th of October in the same year. What rate per cent. per annum of interest have I paid?

No. of days from 5th March till 18th October = (26 + 30 + 31 + 30 + 31 + 31 + 30 + 18 = 227. Interest paid, £2 10s. 6d.

£130 : £100
227 days : 365 days } :: £2½ : rate p.c.

$$£\frac{101 \times 100 \times 365}{40 \times 130 \times 227} = £\frac{184884}{117104} = £3\ 2s.\ 5\tfrac{1884}{1171}d.\ \text{Ans.}$$

FEMALES.

1. Simplify (*a*) ·01001 + 5·27 × ·000483 ÷ ·030

(*b*) 2·3475 of 1 ton + 4·6875 of 1 cwt + ·5 of 3 qrs. − 1·4 lb. / 1·05 of 1 ton.

(*a*) Simpler = 5·28001 × ·0161

	·0161
	528001
	3168006
	528001
	·085008161

(*b*) cwts.

2·3475 tons =	46·95
4·6875 cwt. =	4·6875
·5 of 3 qrs. =	·375
	52·0125 = 52 1/80 cwt.
− 1·4 lbs. = 1·4/112 cwt. =	1/80
	52 cwt.

∴ 52 cwt. / 21 cwt. = 2 10/21 cwt. Ans.

2. If 24 men can do a piece of work in 1·4 days, working 8·1 hours a day, how many hours a day must 28 boys work in order to complete the same in 4·5 days, the work of a boy being half that of a man?

24 men or 28 boys : 48 boys
4·5 : 1·4 } :: 8·1 hours : hours required

$$\frac{8{\cdot}1 \text{ hours} \times 48 \times 1{\cdot}4}{28 \times 4{\cdot}5} = \frac{2{\cdot}16}{{\cdot}5} = 4{\cdot}32 \text{ hours, or } 4\tfrac{8}{25}.\ \text{Ans.}$$

3. Reduce the following mixed circulating decimals, ·14, ·0138, ·2418 to their respective equivalent and vulgar fractions.

·14 = 14/99
·0138 = 138/9999 = 1/73
·2418 = 2414/9999 = 806/3333

Grammar.

1. Prince Henry—'I never thought to hear you speak again.'
King Henry—'Thy wish was father, Harry, to that thought!
I stay too long by thee, I weary thee.
Stay but a little, for my cloud of dignity
Is held from falling with so weak a wind
That it will quickly drop.'

(*a*) Point out and parse all the verbs in the infinitive and imperative moods that occur in the above.

(*b*) Give the meaning of the above passage in your own words.

(*c*) Point out the gerund in the fifth line, and show from its use there that a gerund is a verbal noun.

(*a*) *to hear*—trans. verb, irreg. *hear, heard, heard*, infinitive, present, gov. by *thought*.
(*to*) *speak*—intrans. verb, irreg. *speak, spoke, spoken*, infinitive, pres., gov. by *hear*, after which word the *to* is omitted.
(*to*) *drop*—trans. verb, reg., infinitive, present, forming with the auxiliary *will* the future indef. indicative.
stay—intrans. verb, reg., imper., 2nd pers., sing., agr. with (*thou*.)

(*b*) Prince Henry—I did not expect to see you alive.
King Henry—Such an expectation tells me that you long for my death, and that the length of my life is wearisome to you. Have patience for a short time, for I am getting so weak that the honours you long for will in the course of nature soon be yours.

(*c*) The gerund in the fifth line is *falling*, because, from its being governed by the preposition *from*, it has the syntax of a noun. Participles or verbal adjectives are never thus governed.

1. What is a noun sentence? Give two examples, one in which the noun sentence acts as a nominative to the principal sentence, one in which it acts as the object.

A noun sentence is a subordinate sentence which, like a noun, may be either (*a*) the subject of another sentence, or (*b*) the object of a transitive verb, as:—
(*a*) '*That he committed the fault* could be judged from his looks.'
(*b*) 'I knew *that he was in London*.'

3. Give the meaning of each of the Latin prepositions ad, sub, super, and pre; and show how this meaning may be traced in the words *arrogate, support, superior, prevent*.

Ad means *to: ar*-rogate, to take *to* oneself (too much importance).
sub ,, *under:* as, *sup*-port, put *under* for the purpose of holding up.
super ,, *above, over:* as, *super*-ior, *above* either in rank, or value.
pre ,, *before:* as, *pre*-vent, to hinder (by standing before).

Note.—'Prevent' formerly meant *to come before* (by anticipating).

Geography.

1. Draw a map of Northern Hindostan, showing the basins of the Ganges and the Indus, and the chief towns which stand in those basins.

2. Write a letter, as from a young man who has been travelling in China and Japan, describing what he has seen in those countries.

London, 25th February, 1882.

Dear Sir,—Having been travelling lately in those most interesting lands, *China* and *Japan*, I shall give some information respecting these countries and their inhabitants.

China has an area of nearly two million square miles. Its surface is mountainous in the north, with a great alluvial plain in the centre and east, and is interspersed with mountains and valleys in the south. No country in the world is better watered than China. The climate is subject to extremes, the soil is productive, and every spot of land is diligently improved. There are no forests, and the chief vegetable productions are rice in the low grounds and tea in the hilly districts. The trees peculiar to China are the *tallow*-tree and the *camphor*-tree. Minerals are abundant, the most valuable being kaolin or porcelain clay, Nankin having a tower built of this 200 feet high. The chief industries are agriculture and manufactures of porcelain, silks, and *Nankeen*, which takes its name from the town. The language is very peculiar, each written character representing an idea. The learned men are held in great honour and occupy all the important offices of state. The notions of female beauty are peculiar, small feet being objects of great admiration. The religion of the upper classes is that of Confucius, and that of the lower orders is a species of Buddhism. Of the national works of China the most remarkable is the *Great Wall* on the northern frontier, built to repel the Tartars, 1250 miles long, 15 feet broad, and from 15 to 30 feet high. The *Grand Canal* is 700 miles, 200 feet broad at the surface, and is often from 60 to 70 feet deep.

Rice, the principal food, is eaten with chop-sticks requiring much art to use; pork is a favourite meat, but dog's flesh is considered a delicacy, and even rats and mice are relished by the lower orders; tea is drunk without cream or sugar, and a great luxury is the edible birds' nests from Java.

The people are very deceitful, and in their vanity call their country the 'Celestial Empire.' They are very skilful in carving ivory, but their paintings show no knowledge of perspective.

Japan consists of an extensive archipelago, which may be divided into three main groups. The islands proper are intersected by chains of mountains, several of which are volcanic, and some so lofty as to be covered with perpetual snow. Many of the valleys are fertile; and although the soil is generally poor, like the Chinese, the extraordinary ingenuity and industry of the inhabitants have rendered the most barren spots productive. The Japanese are intelligent and enterprising, and are better educated than any other people of Asia. In the manufacture of sword-blades, porcelain, and lacquered ware they are unrivalled; their silk and cotton cloths are nearly equal to those of China; and by means of the juice of a certain tree they excel particu-

larly in the art of varnishing—hence the origin of the term *Japanning*. Since the war of 1869 all the peculiar prejudices and exclusiveness that had previously characterised the Japanese have been thrown aside. Railways and telegraphs have been introduced; new coinage has been made, and the decimal system of weights and measures is to be adopted. The change which has taken place in the condition of Japan is without a parallel in the history of nations. Japanese of high rank have studied the advanced civilization of Europe and America. Already about half a million are being taught the history, arts, and science of the West. Japan has taken five centuries of a leap and seems to be destined to become in the East what the British Archipelago is to the West.

I am, dear Sir,
Your obedient servant,
PUPIL TEACHER.

To ———, Esq.,
H. M. Inspector of Schools.

SECOND PAPER.

One hour allowed for Females.
Two hours and a half allowed for Males.

History.

1. What was the Spanish Armada? Describe its fate.

The 'Spanish Armada' was a mighty naval force collected at Lisbon for the invasion and subjugation of England, which enterprise was undertaken at the instance of Pope Sixtus V. The Armada was composed of 130 ships under the command of the Duke of Medina Sidonia.

The expedition having left Lisbon in May, 1588, was scattered by a storm, and after being refitted, sailed again in July. Lord Howard, assisted by such seamen as Drake, Hawkins, and Frobisher, harassed their unwieldly enemy with the small and easily-managed English vessels. While lying in Calais roads, the sending of eight fire-ships among the foe was the last blow dealt to the Armada by the hand of man. Terror and confusion followed; they fled through the Straits of Dover, the English ships following in hard pursuit, and the chase lasted to the coast of Scotland. The storms finished the ruin of the Spanish force, and only fifty-two half-wrecked vessels re-entered the ports of Spain.

2. How did William and Mary obtain the crown? Which of the two died first, and what happened then?

By the un-constitutional methods of government pursued by James II., who was bringing all his energies to bear on the re-establishment of Roman Catholicism in England, he was compelled to abdicate the throne, and the crown was given to William, Prince of Orange, and Mary his wife, daughter of James II.

Mary died in 1694, and after that William reigned alone as William III.

3. When was the Dominion of Canada formed, and of what is it composed?

The Dominion of Canada was formed by the federal union of the Provinces of *Canada*, *Nova Scotia*, and *New Brunswick* in 1867. An outlying district of the prairies was in 1870 formed into the Province of *Manitoba* and added to the Dominion, which has been further enlarged by the incorporation in 1871 of *British Columbia*, and in 1873 of *Prince Edward Island*.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Rhapsody*.

Write in small hand, as a specimen of copy-setting, *Nelson has been justly called 'The greatest seaman of all time.'*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

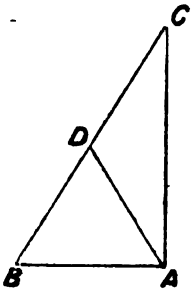
Euclid.

[All generally understood abbreviations for *words* may be used.]

1. If a straight line falling on two other straight lines, make the alternate angles equal to each other; these two straight lines shall be parallel.

See Prop. 27, Bk. I.

2. ABC is a triangle right-angled at A with the angle B double of the angle C; show that CB is double of AB.



At the point A in the straight line AC make the angle CAD = the angle ACD, which (I. 32) is equal to one-third of a right angle. ∴ DC = DA. But the triangle DAB having each of its angles equal to two-thirds of a right angle must be an equilateral triangle (following from I. 32). ∴ DA = DB = BA. Hence DC = DA = BA or BC = twice BA. Q. E. D.

3. In any right-angled triangle, the square which is described upon the side subtending the right angle, is equal to the squares described upon the sides which contain the right angle.

See Prop. 47, Bk. I.

Algebra.

1. Simplify $(a-2b)(2a-b)+3a(a-b)-(2a-2b)^2+2b^2$

$$\begin{aligned}(a-2b)(2a-b) &= 2a^2-5ab+2b^2\\ +3a(a-b) &= 3a^2-3ab\\ -(2a-2b)^2 &= -4a^2+8ab-4b^2\\ +2b^2 &= +2b^2\end{aligned}$$

By addition we obtain a^2 Ans.

2. Prove the rule for finding the greatest common measure of two algebraical expressions.

The proof of the rule for finding the G. C. M. depends on the following principles:

(*a*) If D divide A, then it will divide mA. For since D divides A, we may suppose A$=a$D, then mA $= ma$D; thus D divides mA.

(*b*) If D divide A and B it will divide mA$\pm n$B. For since D divides A and B, we may suppose A$=a$D, and B $= b$D, then mA$\pm n$B$=(m$A$\pm n$B) D; thus D divides mA$\pm n$B.

Let A and B denote the two algebraical expressions, and let them be arranged according to descending powers of some common letter, and suppose the index of the highest power of that letter in A not less than the index of the same letter in B. Divide A by B: let p denote the quotient, and C the remainder. Divide B by C; let q denote the quotient and D the remainder. Divide C by D, and suppose that there is no remainder, and let r denote the quotient. Thus we have the following results:—

B) A (p
pB
C) B (q
qC
D) C (r
rD

A $= p$B$+$C; B $= q$C$+$D; C $= r$D.

Now, D divides C since C $= r$D; hence by principle (*a*) D also divides qC, and also qC$+$D; that is, D divides B. Again, since D divides B and C, it divides pB$+$C; that is, D divides A. Hence, since D divides A and B, it is a common measure of them. D is not only a common measure, but *the* greatest common measure.

By principle (*b*) given above, every expression which divides A and B divides A $- p$B, that is, C; thus every expression which is a measure of A and B is a measure of B and C. Similarly every expression which is a measure of B and C is a measure of C and D. Thus every expression which is a measure of A and B divides D. But no expression higher than D can divide D. Thus D is the G. C. M.

3. Solve the equations:—

1. $\dfrac{a}{x}-\dfrac{b}{a}=\dfrac{a+b}{x}+\dfrac{a^2-b^2}{a^2+ab}$

2. $\dfrac{10x+17}{18}-\dfrac{12x+2}{13x-16}=\dfrac{5x-4}{9}$

(1) Otherwise $\dfrac{a}{x}-\dfrac{b}{a}-\dfrac{a+b}{x}=\dfrac{(a-b)(a+b)}{a(a+b)}$

$$\frac{a^2-bx-a^2-ab}{ax}=\frac{a-b}{a}$$

$$-bx-ab=ax-bx$$

$$x=\frac{-b}{}$$ Ans.

(2) Otherwise. $\frac{10x+17}{18} - \frac{10x-8}{18} = \frac{12x+2}{13x-16}$

$$\frac{25}{18} = \frac{12x+2}{13x-16}$$

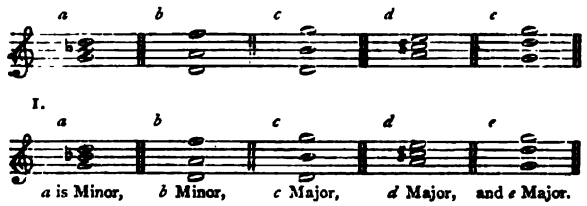
Clearing of fractions $325 - 400 = 216x + 36$

$$109x = 436$$

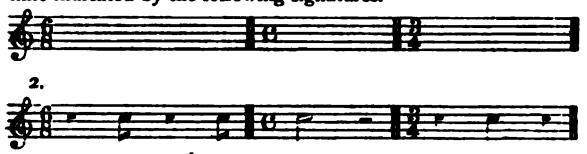
$$x = \underline{4} \text{ Ans.}$$

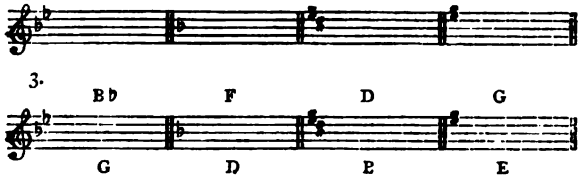
Music.

A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

a is Minor, *b* Minor, *c* Major, *d* Major, and *e* Major.

2. Write a measure, of notes and rests, in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st *May*, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. The divisible receipts of a railway company for 1 year are £437,500, and there are 250,000 shares at £21 each. What is the dividend on each share? and what is the rate per cent. of the company's profits?

(*a*) Divided on each share $= \frac{£437{,}500}{250{,}000} = \underline{£1\ 15s.}$

(*b*) Rate per cent on company's profits $= \frac{£1\frac{3}{4} \times 100}{21}$

$$= \frac{700}{84} = \underline{8\frac{1}{3}} \text{ Ans.}$$

2. A bequest of £1404 is left in equal shares among 3 persons; the first, being a son of the testator, pays a duty of 1 per cent.; the second, being a brother, pays 3 per cent.; the third, not being a relation, pays 10 per cent. What amount does each receive?

(*a*) Each share before payment of duty $= \frac{£1404}{3} = £468$

	£	s.	d.
(*b*) Duty on 1st $= £\frac{468}{100}$	= 4	13	7·2
" 2nd $= £468 \times \frac{3}{100}$	= 14	0	9·6
" 3rd $= £468 \times \frac{1}{10}$	= 46	16	0

(*c*) ∴ After deducting each duty from £468 the respective sums received are

	£	s.	d.	
1st	403	6	4·8.	Ans.
2nd	453	19	2·4.	Ans.
3rd	421	4	0.	Ans.

3. An annuity of £50, payable at end of year, is put out to interest immediately after each payment; what will it amount to in 7 years at 5 per cent. simple interest?

Interest per annum for every £50 = £2½

1st £50 has 6 years' interest, 2nd £50 has 5 years', etc.

∴ No. of years' interest = 6+5+4+3+2+1 = 21 years' interest.

£2½ × 21 = £52 10s. of interest

But besides this interest there are the annuities for 7 years, viz., 7 times £50 or £350

∴ Amount required = £350 + £52 10s. = <u>£402 10s.</u>

4. What is the difference between the *interest* and the *discount* on £135 7s. 6d. for 9 months at 4 per cent.?

(*a*) Interest $= £135\frac{3}{8} \times \frac{3}{4}$ yrs. $\times \frac{4}{100} =$

$$£\frac{1083 \times 3 \times 4}{8 \times 4 \times 100} =$$

$$£\frac{32{\cdot}49}{8} = £4{\cdot}06125$$

$$= \underline{£4\ 1s.\ 2{\cdot}7d.}$$

(*b*) Interest of £100 for 9 months at 4 p.c. = £3

Amount of do. for do. = £103

∴ £103 : £135⅜ :: £3 : discount required.

$$\frac{£3 \times 1083}{103 \times 8} = £\frac{3249}{824}$$

$$= \underline{£3\ 18s.\ 10\frac{529}{824}}$$

	£	s.	d.
Interest =	4	1	$2\frac{7}{10}$
Discount =	3	18	$10\frac{529}{824}$
	2	$4\frac{478}{824}$	Ans.

5. By how much does the compound interest on £527 for 4½ years, at 2½ per cent., exceed the simple interest on the same sum for the same time?

(*a*) Simple interest $= £527 \times 4\frac{1}{2} \times \frac{2\frac{1}{2}}{100}$

$$= \frac{£527 \times 9 \times 9}{2 \times 4 \times 100}$$

$$= \frac{£426{\cdot}87}{8}$$

$$= £53{\cdot}35875 = \underline{£53\ 7s.\ 2{\cdot}1d.}$$

(*b*) To find the compound interest $\frac{2\frac{1}{2}}{100}$ or $\frac{9}{400}$ of the principal for each year must be found, and $\frac{9}{800}$ of the principal for the half yearly interest.

£527		
11·857+		
538·857	= amt. at end of 1st yr.	
12·124+		
550·982	= " " 2nd "	
12·397+		
563·379	= " " 3rd "	
12·676+		
576·055	= " " 4th "	
6·480+		
£582·535	= " " 4½ yrs.	
527		

∴ compound interest = £55·535+ = £55 10s. 8·5d.

and simple " = 53 7 2·1

difference = 2 3 6·4. Ans.

FEMALES.

1. A man having 750 sheep, sold 8 per cent of them to A, 90 of them to B, and 3½ per cent. of the remainder to C; how many sheep had he still?

8 p. c. of 750 $= \frac{750 \times 8}{100} = 60$ sheep sold to A,

and since 90 more were sold to B,

∴ 3½ p. c. of (750 − 150) $= \frac{600 \times 7}{200} = 21$ sold to C.

∴ No. left = 750 − (150+21) = <u>579.</u> Ans.

2. A man sold 5 loads of barley, each containing 34 bus. 2½ pks., for £40 7s. 11d. How much ought 100 qrs. of the same barley to be worth?

(34 bus. 2½ pks.) × 5 = 692½ pks.
100 qrs. = 3200 „
£40 7s. 11d. = 9695d.
∴ 692½ pks. : 3200 pks. :: 9695d. : price required.
$£\frac{9695}{692\frac{1}{2}} \times \frac{3200}{1} = £\frac{19390}{13} =$ £186 13s. 4d. Ans.

3. If 24 lbs. of wool make 115 yards of cloth, one yard wide, how much cloth 1¼ yard wide ought 12 oz. to make?

24 lbs. : ¾ lb. } :: 115 yds. : quantity required.
5 qrs. : 4 qrs. }

$\frac{115 \text{ yds.} \times 3 \times 4}{96 \times 5} =$ 2 yds. 3 qrs. 2 nls. Ans.

4. Find the present worth of £838, due 19 months hence, at 3 per cent. simple interest.

Interest of £100 for 19 mos. at 3 p. c. $= \frac{3 \times 19}{12} = £4\frac{3}{4}$
Amount of do. do. $= £104\frac{3}{4}$
∴ £104¾ : £100 :: £838 : present worth required.

$\frac{£838 \times 100 \times 4}{419} =$ £800. Ans.

Grammar.

1. 'All the skie was of a fiery aspect, like the top of a burning oven, the light *seene* above forty miles round about for many nights. The noise, and cracking, and thunder of the impetuous flames, ye shrieking of women and children, the hurry of people, the fall of towers, houses, and churches, *was like an hideous storme*, and *the aire* all about so hot and *inflam'd* that at last one was not *able* to approach it, *so that* they were forced to stand still and *let* the flames *burn on*, *wch* they did [for neere two miles in length and one in bredth.'

Evelyn's Diary.—The Fire of London.

(*a*) To what period of the English language does the above passage belong?

(*b*) How many sentences does it contain, and of what kinds?

(*c*) Analyse fully to the first full-stop.

(*d*) Parse the words in italics.

(*a*) The above passage belongs to the period called 'Modern English.'

(*b*) It contains the following sentences:—

1. '*All the skie, etc. . . . . nights.*' Principal.
2. '*The noise, etc. . . . . storme.*' Principal.
3. '*And the aire all about* (*was*) . . . . *inflamed.*' Principal.
4. '*That at last. . . . . approach it.*' Subordinate adverbial.
5. '*So that. . . . . stand still.*' Subordinate adverbial.
6. ('*So that . . . . forced*) *to let . . . . burn on.*' Subordinate adverbial.
7. '*Which they, etc. . . . . in bredth.*' Subord. adj. to (6.)

(*c*) '*All*' adj., enlarging the subject.
'*the skie*' simple subject.
'*was*' incomplete predicate.
'*of a fiery aspect*' prep. phrase completing predicate.
'*like the top of a burning oven*' adj. phrase extending predicate.
'*the light, etc. . . . nights.*' absolute phrase still further extending the predicate.

(*d*) *seene*—intrans. verb, irreg., *see, saw, seen*, complete part., used absolutely with *light*.
was—subst. verb, irreg. *am, was, been*, indic., pres., 3rd pers., sing., agreeing with (it) the different noises making the *one* storm.
like—adj. used predicatively of (it) the noise.
an—indef art. or adj. limiting *storme*.
hideous—adj. qual. *storme*.
storme—com. noun, neut., sing. obj. gov. by (to); or dative case after *like*.
the—def. art. or dist. adj. limiting *aire*.
aire—com. noun, neut. sing. nom. subj. of (was).
inflamed—adj. predicative of *aire*.
able—adj. predicative of *one*.
so that—subordinating conj. phrase introducing the sent. '*they were forced to stand still.*'
(to) *let*—trans. verb, irreg. *let, let, let*, infin., pres. indef. gov. by *forced*.
(to) *burn*—intrans. verb, irreg. *burn, burnt, burnt*, infin. pres. indef. gov. by *let*.
on—adv. of time modif. *burn*.
which—simple rel. pron. 3rd pers. sing. neut. referring to the 'act of burning,' obj. gov. by *did*.

2. Show that the English language furnishes proof of the various races that have inhabited our country.

The English language affords evidence of the different races which have inhabited our country from the traces of their languages found in everyday words, but more especially in the *names of places*. For example, we have traces
of the *Celts* in *Kent, Avon, Ouse, Dee, Derwent, Pen-y-gant*, etc.
of the *Romans* in *Stratford, Lincoln, Chester, Doncaster, Tadcaster*, etc.
of the *Danes* in *Grimsby, Scawfell, Stockgill, Force, Langholm, Wansbeck*.

French had a greater hold on the upper classes and in Law Courts. To this day the royal assent to Bills is announced in Parliament in the French words *Le Roi*, or, *La Reine le veut*. The *O Yes* of the Crier is a relic of the French *ouies!* hear.

Geography.

1. Draw a map of the Western shores of the Pacific Ocean.

2. Write a letter, as from a young man who has been travelling in South America, describing what he has seen; especially the mountains, rivers, forests, beasts, birds, and general appearance of the country.

LONDON, *25th February*, 1882.

DEAR SIR,—Having been travelling in South America, I shall endeavour to give you some information about that country.

In no part of the world are the natural features more boldly marked. Its mountains, rivers, and plains are on a scale of unusual magnificence. The gigantic Andes are the longest unbroken range of lofty summits on the globe. They extend from the Strait of Magellan to the Isthmus of Panama, a length of 4,400 miles, and enclose table-lands whose general elevation is 6,000 ft. above sea-level. Chimborazo, Aconcagua, Sahama, and Gualatieri are among the highest summits, and Cotopaxi is the most dreaded of all the volcanoes.

The Amazon, navigable for 2,000 miles, flows eastward about 4,000 miles, expanding before it reaches the Atlantic into an estuary 180 miles wide. Next to it in magnitude is the La Plata, which, 200 miles from its mouth, is 30 miles wide, and after a course of 2,350 miles pours its waters into the Atlantic by a magnificent estuary 150 miles broad. The Orinoco enters the Atlantic by about fifty channels after a course of 1,480 miles. It is navigable for about 1,000 miles from its mouth, and in the beginning of its course forms a remarkable communication by the Cassiquiari with the Rio Negro, a tributary of the Amazon.

The *forests* of the Caracas possess inexhaustible supplies of timber, the *selvas* of the Amazon and of the Upper Orinoco comprising an area equal to more than six times the size of France. The primeval forests of such extent consist of trees of many different orders and immense size, clothed with climbing plants, and are so dense that the explorer has to hew his way at every step. The forest trees are palms of different species—tree-ferns, mahogany, log-wood, Brazil-wood, and the medicinal Peruvian bark is found on the higher slopes of the Andes.

Most of the animals of South America are peculiar to it. The principal wild ones are the jaguar and puma; the tapir and peccary, or American hog; the sloth, ant-eater and armadillo; opossums and monkeys; the condor, found in the Andes of the equator; the rhea, or American ostrich, parrots, and hummingbirds. The llama and alpaca are confined to the Andes of Chili and Peru, and are wool-bearing animals.

Generally speaking, its surface may be regarded as a continuation of North America, interrupted only by the Gulf of Mexico, namely, a great central plain, with the mighty chain of the Andes on the West and the secondary ranges of Brazil on the East. This great central plain exhibits the three vast basins of the Orinoco, the Amazon, and the La Plata, affording the most extensive system of inland navigation in the world. It also is divided into the *llanos* in the north, the *selvas* in the middle, and the *pampas* in the south.

I am, dear sir, your obedient servant,
PUPIL TEACHER.

To ——, Esq.,
H. M. Inspector of Schools.

SECOND PAPER.

One hour allowed for Females.
Two hours and a half allowed for Males.

History.

1. What Houses have reigned in England since 1066? Give name and date of the first Prince of each House.

		A.D.
House of Normandy.....	William I.	1066
,, Plantagenet.....	Henry II.	1154.
,, Lancaster	Henry IV.	1399.
,, York	Edward IV.	1461.
,, Tudor	Henry VII.	1485.
,, Stuart	James I.	1603.
,, Brunswick	George I.	1714.

2. When was the Act of Settlement passed? What are its provisions, and what change did it make in the position of the judges?

The Act of Settlement, passed in 1701, settled the Crown, in default of heirs of Anne or of William, upon the grand-daughter of James I. and daughter of Elizabeth, Queen of Bohemia, the Princess Sophia, Electress of Hanover, and her heirs being Protestants. It confirmed and added to the Bill of Rights. Some of its provisions have been repealed, but amongst those still in force are: (1) that judges cannot be removed during good behaviour, and only on an address to the Crown from both Houses of Parliament; (2) that no pardon granted by the Crown can be pleaded against an impeachment of the Commons.

An alteration made in 1706 provides that any member of the House of Commons who accepts office under the Crown shall resign his seat and offer himself again for election.

3. Mention some of the leading measures taken since 1828 to ameliorate the condition of Ireland.

(1) Catholic Emancipation Act, enabling Roman Catholics to sit in Parliament, passed ... 1829
(2) Irish Reform Bill, passed 1832
(3) Disestablishment and disendowment of the Irish Church 1869
(4) Tenure of Land Act 1870
(5) Irish Land Bill 1881

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Rhapsody*.

Write in small hand, as a specimen of copy-setting, *Nelson has been justly called 'The greatest seaman of all time.'*

Composition.

Describe some large public building with which you are familiar, its architecture and uses.

THE CRYSTAL PALACE.

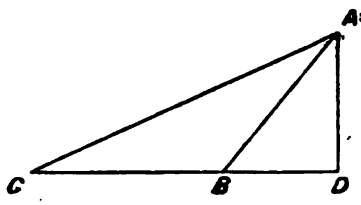
The new Crystal Palace stands nearly north and south on the summit of Penge Hill, and is constructed almost entirely of glass, bound together with ribs and framework of iron. The entire length is 1,608 feet, and the wings 574 feet each, making a length of 2,756 feet, which with the 720 feet in the colonnade leading from the railway station to the wings, gives a total length of 3,476 feet. The width of the nave or main avenue is 72 feet, and the height 68 feet; the height from the flooring to the crown of the arch is 104 feet. The building has a magnificent transept in the centre, and one at each end. The ends of the edifice extend into large wings, which project to a considerable distance forward into the grounds. These wings are terminated with grand glass-towers, from which may be obtained extensive views of the gardens, fountains, and grounds, and also an extensive view of the surrounding country. The whole of the sides of the nave, the transept, and the divisions on either side, between the several courts of which the interior consists, are adorned with trees and plants of every clime; the whole being interspersed with fountains, statues, and other works of art. On the north-east side are ranged in consecutive order the historical galleries of architecture and sculpture, with casts of the finest remains of ancient art. On the south-east side of the nave there are similar collections of mediæval antiquity. The south-west and north-west divisions of the building are devoted to the exhibition of manufactures and productions of practical utility. There are also various courts for exhibiting the productions of manufacturing industry; as the French, the mixed fabrics, the printed fabrics, the musical instruments, the Sheffield, the Birmingham, the stationery, and the Bohemian glass. The Palace has become a very favourite resort for Londoners and country visitors to town, and its first-class concerts, flower-shows, and musical festivals attract immense crowds of the higher and middle classes of society.

Euclid.

[All generally understood abbreviations for *words* may be used.]

1. If one angle of a triangle be four-thirds of a right angle, the square on the side subtending that angle is equal to the sum of the squares on the sides containing it, together with the rectangle contained by these sides.

Let the angle at BC be equal to four-thirds of a right angle, then if CB be produced the angle ABD is two-thirds of a right angle, which is the angle of an equilateral triangle. From A let fall the perpendicular AD, then ADB is the half of an equilateral triangle and AB is double of BD. (*See Euclid of 3rd year.*)



Now by II. 12, the square on AC = square on AB, the square on BC, and twice the rectangle CB·BD, but BD is = the half of BA, and ∴ the rectangle CB·BA is equal to twice the rectangle CB·BD, wherefore the square on AC is equal to the squares on AB·BC and the rectangle contained by the sides CB·BA. Q. E. D.

2. If a straight line be bisected and produced to any point the rectangle contained by the whole line thus produced, and the part of it produced, together with the square on half the line bisected, is equal to the square on the straight line which is made up of the half and the part produced.

See Prop. VI. Bk. II.

3. Enunciate (without proving) the geometrical proposition which corresponds with the algebraical identity $(x+y)^2 = x^2 + y^2 + 2xy$.

If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the parts.

Algebra.

1. Prove that $(2a-b)^3 - (a-2b)^3 = (a+b)\{7(a-b)^2+ab\}$

$$(2a-b)^3 = 8a^3 - 12a^2b + 6ab^2 - b^3$$
$$-(a-2b)^3 = -a^3 + 6a^2b - 12ab^2 + 8b^3$$

By adding, we have $7a^3 - 6a^2b - 6a^2b + 7b^3 =$
After subtracting and adding—
a^2b and ab^2

$$7(a^3 - a^2b - ab^2 + b^3) + a^2b + ab^2 =$$
$$7\{a^2(a-b) - b^2(a-b)\} + ab(a+b) =$$
$$7\{(a^2-b^2)(a-b)\} + ab(a+b) =$$
$$\{7(a-b)(a-b)(a+b)\} + ab(a+b) =$$
$$(a+b)\{7(a-b)^2 + ab\} \quad \text{Q. E. D.}$$

2. Simplify $\dfrac{a-x}{(a+x)^2} - \dfrac{2(a^2-ax+x^2)}{(a-x)(a^2-x^2)} + \dfrac{a+x}{(a-x)^2}$

L. C. M. of Denrs. $= (a+x)^2(a-x)^2 = (a^2-x^2)^2$

$$\therefore \frac{(a-x)^2 - 2(a^2-ax+x^2)(a+x) + (a+x)^2}{(a^2-x^2)^2} =$$

$$\frac{a^3 - 3a^2x + 3ax^2 - x^3 - 2a^3 - 2x^3 + a^3 + 3a^2x + 3ax^2 + x^3}{(a^2-x^2)^2} =$$

$$\frac{2a^3 + 6ax^2}{(a^2-x^2)^2} = \frac{2x^2(3a-x)}{(a^2-x^2)^2}. \quad \text{Ans.}$$

2. Solve the equations:—

$$(1.)\ \begin{cases} 2\frac{1}{2}x - 3\frac{1}{3}y + 33 = 0 \\ 3\frac{1}{2}x - 5\frac{1}{4}y + 22 = 0 \end{cases}$$

$$(2.)\ \frac{x}{x-1} + \frac{x+2}{x+1} = \frac{8}{4(x-2)}\ x\ 13$$

(1.) Otherwise $10x - 42y = -132$ (multiplying by 4)
$10x - 31y = -66$ (,, 3)

$$11y = 66$$
$$y = 6$$

By substitution $x = 12$

(2.) Clearing of fractions :—

$$8x^3 - 8x^2 - 24x + 16 = 8x^3 - 13x^2 - 8x + 13$$

Collecting ... ... $5x^2 - 16x = -3$

Dividing by 5 .. $x^2 - \frac{16}{5}x = -\frac{3}{5}$

Squaring ... ... $x^2 - \frac{16}{5}x + \frac{64}{25} = \frac{64}{25} - \frac{15}{25} = \frac{49}{25}$

Taking root ... $x - \frac{8}{5} = \pm\frac{7}{5}$

$x = \frac{8}{5} \pm \frac{7}{5}$

$\therefore$ $x = 3$ or $\frac{1}{5}$. Ans.

Mensuration.

1. The hypotenuse of a right-angled triangle is 617 feet, and one of the sides is 105 feet. Find the area in acres.

(*a*) The third side $= \sqrt{617^2 - 105^2} = \sqrt{380689 - 11025} = \sqrt{369664} = 608$.

$\therefore$ Area $= \frac{\text{base} \times \text{perp.}}{2} = 105 \times 608 \times \frac{1}{2} = 105 \times 304 =$ 31920 sq. ft. $= \frac{1}{2}$ ac. 37 po. 7 yds. 3 ft. 108 in.

2. The chord of an arc of a circle whose radius is 9 inches is 6 inches. Find the length of the arc.

(*a*) To find the chord of half the arc.

(1) $\sqrt{(\text{Radius})^2 - (\frac{1}{2}\text{ chord of arc})^2} = \sqrt{9^2 - 3^2} =$ 8·48 in. (nearly).

$\therefore$ 9 in. − 8·485 in. = ·515 in. the height of the arc.

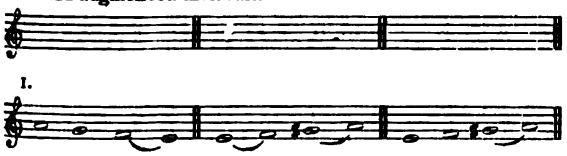
(2) $\sqrt{3^2 + \cdot 515^2} = \sqrt{9\cdot 265225} = 3\cdot 029$ in. chord of half arc.

(*b*) $\text{length of arc} = \frac{(\text{The chord of half the arc} \times 8) - \text{chord of the whole arc}}{3} = \frac{3\cdot 029 \times 8 - 6}{3} = 6\cdot 077$ inches (nearly).

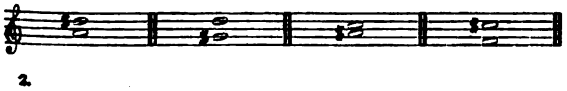
Music.

A quarter of an hour allowed for this paper.

1. Write the upper tetrachord of A (*La*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



1.

2. Write, under each of the following pairs of notes, the name and quality (major, perfect, diminished, or other) of the interval it forms.

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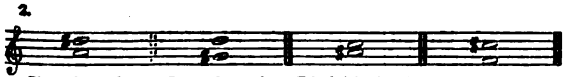
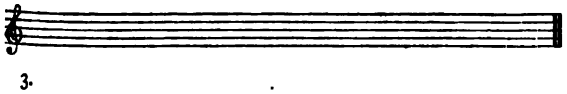
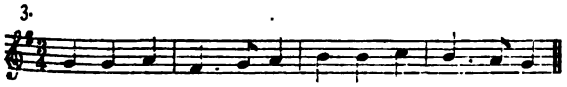


Pluperfect 4th. Imperfect 5th. Diminished 3rd. Augmented 5th.

3. Write, from memory, the first four measures of the National Anthem.



3.



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ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR APRIL, 1882.

EXERCISE II.

(1) 2, 2, 2, 3, 3, *a*, *a*, *a*, *b*, *b*, *c*. (2) 17 and $\frac{1}{2}$. (3) 10*abc* and 15*abc*

EXERCISE III.

(1) 6*aaabbbbc* and *xxxyyz*. (2) 35. (3) 99. (4) 85. (5) 128. (6) $11\frac{1}{2}$. (7) $14\frac{3}{4}$. (8) 31. (9) 126. (10) 6075. (11) 42525. (12) 1296.

EXERCISE IV.

(1) $a+b+c+d+e+f$. (2) $a-b-c-d-e-f$. (3) 15. (4) $a+b-c-d+e-f$. (5) $a-b-c+d+e-f+g$. (6) $a^2-bc-c+de-f-g$. (7) $a^2-b^2+c^2-bc+g-h$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR APRIL, 1882.

STANDARD III.

A. 1. 2,853,615—12.
2. 20,369—4.
3. 1085—165.

B. 1. 10,903—71.
2. 7889—8864.
3. £4532 11s. 7$\frac{3}{4}$d.

C. 1. £79,824 15s. 3$\frac{1}{4}$d.
2. 4796—68471.
3. £599 18s. 9$\frac{1}{2}$d.

D. 1. 62—64,634.
2. £32 11s. 9d.
3. One million and one.

E. 1. 7,709,772.
2. £2 17s. 11d.
3. £1,873 12s. 6d.

F. 1. 133 rem.
2. £464 13s. 11$\frac{3}{4}$d.
3. 884—1933.

ADVANCED EXAMINATION.

1. £3585 6s. 4d.
2. 39 oranges.
3. £1 2s. 1d. (lamb).

STANDARD IV.

A. 1. £21,918 7s. 2$\frac{1}{2}$d.
2. £82,387 9s. 3d.
3. £232 8s. 9$\frac{1}{2}$d.

B. 1. £9527 12s. 3$\frac{3}{4}$d.
2. £1110 10s. 9$\frac{1}{2}$d.
3. 31,536,000 sec.

C. 1. £448 16s. 2$\frac{3}{4}$d.—136.
2. 2489084 d.
3. 251 tons, 8 cwt. 1 qr. 24 lbs. 6 ozs.

D. 1. £156 5s.
2. 13s. 11$\frac{1}{2}$d.—72641.
3. 3,722,400 inches.

E. 1. £8145 9s. 11$\frac{1}{4}$d.
2. £6048.
3. July 2nd.

F. 1. 360,547,840 dr.
2. 2294 books.
3. 69,696,000 sq. feet.

ADVANCED EXAMINATION.

1. 1160 oranges.
2. £486.
3. £4,570,860 12s.

STANDARD V.

A. 1. £174 2s. 7$\frac{1}{2}$d.
2. £290 19s. 11$\frac{1}{2}$d.
3. £864 12s. 2$\frac{1}{4}$d.

B. 1. £14,048 4s. 0$\frac{3}{4}$d.
2. £6549 16s. 3$\frac{3}{4}$d.
3. £244,655 18s. 6$\frac{1}{4}$d.

C. 1. £7697 6s.
2. £49,734 15s. 3$\frac{1}{2}$d.
3. £157,785 17s. 9$\frac{3}{4}$d.

D. 1. £16 16s. 6$\frac{1}{4}$d.
2. £28 8s. 8$\frac{1}{12}$d.
3. 189 oranges.

E. 1. £4522 9s. 1$\frac{1}{2}$d.
2. £590 0s. 3$\frac{3}{8}$d.
3. 18 additional men.

F. 1. 550.
2. £189 4s. 1$\frac{4}{7}$d.
3. £115.

ADVANCED EXAMINATION.

1. £19 12s. 3$\frac{1}{2}$d.
2. 22s. 6d., 11s. 3d., 3s. 9d.
3. £43 8s. 2$\frac{18}{19}$d.

STANDARD VI.

A. 1. 8$\frac{1}{8}$.
2. 17s. 8$\frac{1}{4}$d.
3. $\frac{7}{8}\frac{6}{5}$ G.

B. 1. 4019·73.
2. ·00024609375.
3. £1 7s. 7$\frac{1}{4}\frac{3}{8}$d.

C. 1. 8$\frac{8}{2}$ hours.
2. 420 mice.
3. £3 17s. 7$\frac{1}{3}\frac{3}{0}\frac{3}{0}$d.

D. 1. $\frac{1}{1}\frac{0}{8}\frac{7}{3}\frac{8}{3}\frac{0}{3}$.
2. ·00100075.
3. 1458$\frac{1}{2}$ loaves.

E. 1. £3 16s. 1$\frac{1}{2}$d.
2. $5\frac{5}{6}$ hours.
3. ·008763.

F. 1. $\frac{4}{25}$.
2. $3\frac{1}{0}\frac{1}{0}\frac{7}{0}$ G.
3. $1\frac{4}{0}\frac{7}{3}\frac{5}{4}$ cwt.

ADVANCED EXAMINATION.

1. £43 4s.
2. $\frac{3}{1}\frac{7}{0}\frac{2}{7}\frac{2}{1}\frac{3}{2}\frac{7}{3}\frac{3}{0}\frac{3}{0}$ or ·314232 +
3. $11\frac{3}{17}$ hours.

STANDARD VII.

A. 1. $\frac{2}{2}\frac{4}{4}\frac{3}{0}\frac{1}{0}\frac{0}{0}$ half cr.
2. £108 18s. 9d.
3. $3\frac{17}{1}$ per cent.

B. 1. 33 marbles.
2. £895 14s. 3$\frac{3}{4}$d.
3. $2\frac{5}{1}\frac{0}{0}\frac{0}{8}$ years.

C. 1. 5806.
2. $5\frac{3}{3}\frac{8}{0}\frac{8}{8}$ per cent.
3. $14\frac{2}{7}$ per cent.

D. 1. £550 16s. $11\frac{2}{3}\frac{3}{0}$d.
2. £561 9s. $10\frac{2}{3}\frac{0}{0}\frac{4}{0}\frac{4}{7}$d.
3. 265.

E. 1. £10 19s. 0$\frac{3}{4}$d.
2. $6\frac{1}{5}\frac{8}{0}$d. a lb.
3. July 22nd, at 8.13 p.m.

F. 1. £13 8s. 4·092d.
2. £148 12s. 6·2976d.
3. £80,000 (ship).

ADVANCED EXAMINATION.

1. 8 and 40 hours.
2. £216; $5\frac{2}{3}$ per cent.
3. $31\frac{2}{3}$ per cent.

THE TRAVELLING TINKER.

Words by GEO. BENNETT. *Music by* T. CRAMPTON.

Lively.

1st TREBLE.
2nd TREBLE.
BASS.

1. A-ny knives, now, or scissors, to grind? A-ny saucepans or ket-tles want mending? A-ny brok-en un-
2. "It is ne-ver too late to mend" Is a pro-verb as old as your gran-ny; Then don't grudge the
3. A-ny ra-zors to grind or to set? We'll fet-tle them up as re-quest-ed; So sharp, that a

KEY A. *Lively.*

1st TREBLE.
2nd TREBLE.
BASS.

- brel-las? you'll find We'll make them worth us-ing or lend-ing: Then, bring 'em out now, and we'll show Our
tri-fle you spend, And fan-cy you might be more can-ny: Your knives we'll make bet-ter than new— Good
hair they would split, Or bar-ber a hedgehog, if test-ed! We're gri-my—but that's the trade mark; You'd

s.d.f. F.

words are as true as the di-al— We're trust-y and quick, as you'll know, If you on-ly give us a tri-al
tin-kers are always pains-tak-ing; We'll charge you but lit-tle, and you The best of the bargain are mak-ing.
think we weren't tinkers without it; But off goes the lathe now—and hark! Your job we'll be speedy a-bout it.

CHORUS. *f*

While round go the wheels and the stones, With a spar-kle, a hiss, and a rum-ble: Oh, the tin-ker's a man who

A. l.m.t. CHORUS. *f*

Symph.

earns what he can, And if he's but paid, he don't grum-ble!

Symph.

We beg to announce that any of the songs which have appeared in the back numbers of the PRACTICAL TEACHER may now be obtained separately, price 1d. per dozen, post free.

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The New Code, 1882.

BY J. R. LANGLER, B.A., F.R.G.S.,

President of the National Union of Elementary Teachers.

THE 'Minute of 6th March, 1882, establishing a New Code of Regulations, by the Right Honourable the Lords of the Privy Council on Education' has been for nearly a month under examination and discussion, not only by the public elementary teachers, whose comfort is so intimately connected with its provisions, but also by a large and happily increasing number of our countrymen whose attention is either attracted or compelled to the subject of popular education.

The presentation to Parliament last August of the 'Proposals' for this new code afforded an opportunity for their consideration by public educational bodies, and this unprecedented courtesy on the part of the Lord President of the Council and of the Vice-President of the Committee of Council on Education has resulted in many important modifications of the proposed changes.

We gather from the non-publication of the changes effected by this 'Minute' that it is not to be regarded as a revised code, but that, as is intimated in the title cited above, it is a 'New Code,' and will probably be quoted in the history of education in this country as the 'Mundella Code' to distinguish it from the 'Lowe Code,' which, during the last twenty years, has undergone annual revision. So cumbrous in all respects is the actual Code, that perplexed managers 'without legal training' have frequently erred through ignorance, and the Department has been enormously taxed for authoritative explanations of its provisions. This Code of 1882 will come into force after 31st March, 1883. It contains 137 Articles arranged in an entirely new form. Supplementary rules and exceptions have disappeared or are embodied in the altered language of the new and classified regulations. This concession to a frequently urged demand might alone entitle it to be called *new*.

The Articles are arranged in four parts:—

Part I. ELEMENTARY SCHOOLS, with chapters headed 'Definitions,' 'Inspection,' 'Teachers,' and 'Annual Grants.' Part II. TRAINING COLLEGES. Part III. PENSIONS. Part IV. REVISION OF THE CODE. In this last Part it is provided (Art. 135) that any article may be cancelled or modified as is the case under article 119 in the present Code. We have not reached perfection; and judging by experience, there will be need for 'revision.' Six schedules are appended.

Our limits will only permit us to indicate the chief novel features of this Code, some of which give it an indisputable claim to the title *new*.

1. There are to be seven standards instead of six, and the first schedule shows the minimum requirement for a pass in each of the three elementary subjects—reading, writing, and arithmetic. The standard will be nearly as at present, and seems to be sufficiently high for the average child. The arithmetic will be somewhat different—certainly not less difficult—in all the standards. The addition and subtraction of 'fractions with denominators not exceeding ten' will be required in the fifth standard. At present 'vulgar

fractions' are prescribed in the sixth standard *after* practice.

2. There are five recognised 'class subjects,' of which English must always be one. This must be taken 'throughout the school,' if at all. Only one other is allowed: in the 'lower division,' Standards I., II., III. (and IV., optional), geography *or* elementary science; and, in the 'upper division' (which *may* include Standard IV.) geography, elementary science, or history. If either 'division' take a second 'class subject,' the other 'division' must take one also. Needlework, according to the 3rd schedule, may be taken as a second class subject for girls, but in mixed schools only. Schedule 2 prescribes that these subjects 'should be taught by means of reading books and oral lessons.' In some cases this will involve the purchase of more than the 'two sets' of books required for the elementary subjects. The 'English' includes literature, which now is no longer retained among the 'specific' subjects. We expect that 'English,' as now arranged, will be sufficient in the majority of cases to tax the resources of the best teachers without the addition of another class subject. The suggestive schemes given in the schedule may be substituted by others if they are 'graduated' or 'progressive,' and are approved by H.M. Inspector. This provision may be very beneficial.

3. There are to be twelve specific subjects—algebra, Euclid, mechanics (with alternative schemes), Latin, French, animal physiology, botany, principles of agriculture, chemistry, physics in two branches, viz., acoustics, etc., and magnetism, and, lastly, domestic economy. This twelfth 'specific' will combine both branches now taught as alternatives. German and physical geography are omitted, the latter being included in the 'class' subjects. Mathematics and mechanics have each undergone subdivision, and physics and agriculture are new. Two specific subjects may be taken, but only by scholars above the fourth Standard. None will be examined if 'at the last preceding inspection the percentage of passes in the elementary subjects was less than seventy.' Girls over twelve years of age may earn a grant for simple attendance during forty hours at an approved 'cookery class.' No provision is made for children who have passed the seventh standard.

4. The minimum School Staff required is slightly changed. The principal certificated teacher will suffice for sixty children as heretofore, and may have three pupil teachers, each of whom will count for forty scholars. Each additional certificated teacher will suffice for eighty children, and each assistant for sixty. Any assistant if provisionally or fully certificated (even third class) will entitle the school to the employment of another pupil teacher or candidate. The 'candidate,' however, will only be sufficient for twenty scholars, and, before he is accepted as a pupil teacher, must pass the elementary and two class subjects in Standard V. or VI. There does not seem to be any Departmental limit to the Staff.

5. Registration will be made more simple by the abolition of 'The Child's Book.' This is a great boon. In calculating the 'average attendance' in half-time schools, *two* attendances will count as *three*. A separate register for half-time will be required.

6. Presentation for Examination. (1.) 'All scholars whose names have been on the Registers for the last twenty-two weeks that the school has been open, must be presented for examination according to one of the Standards,' and 'in a Standard higher than the one in which he has before been presented, whether in his present, or in any former school.' All exceptions are to be specially explained in writing to the Inspector. (2) All such scholars must also be presented in 'Class Subjects,' when these are taken. (3.) The 'Specific Subjects' are limited to two out of the twelve specified, and the examination is confined to scholars above the Fourth Standard. The Fourth Schedule prescribes the three required stages, and no 'scholar, after being examined in one subject, may change it for another, before passing all the stages of the first.' Nor may he be presented twice in the same stage.

GRANTS.

7. The proposed method of distributing the annual grants and, perhaps, the most distinct claim to the title gives to this 'Code 1882' a third 'new.' The mode of payment, except for the specific subjects, is entirely altered. The *average attendance* is the new basis for most of the annual grants. These are to consist of—

(*a*) A *fixed grant* of 4s. 6d.

(*b*) A *merit grant* of 1s., 2s. or 3s., according as the Inspector, 'allowing for circumstances,' reports the school to be 'fair, good, or excellent' in respect of (1), organisation and discipline; (2), intelligence employed in instruction; and (3), the general quality of the work, especially in the elementary subjects.

(*c*) A *grant for needlework* of 1s.

(*d*) A *grant for singing* of 1s. for children taught by *note*, *i.e.*, by any recognised notation; or 6d. if taught by *ear* satisfactorily.

(*e*) A *grant on examination in the elementary subjects* at the rate of 1d. for every unit of percentage. The percentage of passes will be determined by the ratio of the passes actually made to those that might have been made by all scholars liable to examination, who are either examined, or are absent, or withheld from the examination without reasonable excuse.

(*f*) A *grant on examination in class subjects* of 1s. or 2s. for each subject, according as the Inspector reports the examination to be fair or good.

(*g*) A *grant on the examination of individual scholars in specific subjects* of 4s. for each scholar passing in any subject.

It will thus be seen, that in a school of one hundred children taught in the most efficient manner possible, the grants claimable may be thus calculated under the heads above-named as follows:—

		£	s.	d.
Fixed Grant	100 × 4s. 6d. =	22	10	0
Merit	100 × 3s. =	15	0	0
Needlework (say) ...	50 × 1s. =	2	10	0
Singing	100 × 1s. =	5	0	0
3 Elementary Subjects ...	100 × 8s. 4d. =	41	13	4
2 Class Subjects	100 × (2s. × 2) =	20	0	0
2 Specific Subjects (say) ...	20 × (4s. × 2) =	8	0	0
		£114	13	4

Or about £1 2s. 11d. per head, an amount which, of course, can rarely be earned.

The limitations of '17s. 6d. for each unit of average attendance,' and 'the total income of the school from all sources other than the Grant,' are retained. Scholars' Honours' Certificates will no longer be issued.

The estimate for next year is calculated at 16s. per unit of the percentage.

8. Infant Schools and Classes under this New Code will apparently receive much encouragement. The average attendance may now include scholars not under three years old.

(*a*) The *fixed grant* will be 9s., or, to classes, 7s.

(*b*) The *merit grant* will be 2s., 4s., or 6s., according as the Inspector reports the School or Class to be fair, good, or excellent, having regard to the provision made for (1), suitable instruction in the elementary subjects; (2), simple lessons on objects, and on the phenomena of nature, and of common life; and (3), appropriate and varied occupations; provided always, that the elementary subjects are satisfactorily taught.

(*c*) The *grant for needlework* will be 1s. Boys may be taught needlework.

(*d*) The *grant for singing* will be 1s. (by note), or 6d. (by ear), as in the case of the older scholars.

9. All infant scholars over seven years of age must be examined in the First Standard, and in no higher standard except with the special sanction of the Department. A class of more than sixty children must have a certificated teacher, and forty infants will require a teacher over eighteen years of age, approved by the Inspector.

10. Evening Schools will probably be revived under the encouragement of

(*a*) A *fixed grant* of 4s. if the school has met not less than forty-five times since the last examination, or 6s. if more than sixty times within that period; and

(*b*) A *grant on the examination of individual scholars* in any of the elementary class or specific subjects, amounting to 2s. for each scholar passing in each subject.

The limitations of article 113 seem to be necessary, and we may hope that many evening schools will be re-established.

11. The teachers recognised by the Department are

(*a*) Pupil teachers.
(*b*) Assistant teachers.
(*c*) Provisionally certificated teachers.
(*d*) Certificated teachers.
(*e*) Evening school teachers.

These last need not be lay persons. We are glad to find in article 45 a reference to the 'profession of elementary school teachers.' We trust that soon there will be in this country but one profession, embracing teachers of all classes, and whose qualifications are duly certified by some responsible public body. Graduates of any university in Great Britain or Ireland, and women over eighteen years of age who have passed any one of eleven specified university examinations, may be recognised as assistant teachers, and, like other assistants, may, after at least twelve months' service in a school, sit for a certificate under the usual conditions. All candidates to be entitled to have the superintendence of pupil teachers must now pass in the second year's papers and after next Christmas teachers who do not pass in the second year's papers will not be ranked above the third class. Third class certificates can only be raised by examination, and this must not be more frequent than once in two years. We think that Article 65 might have been advantageously modified, so as to permit the revision of second class certificates held by graduates within a period of less than ten years.

Part II. on Training Colleges, Part III. Pensions, and Part IV. contain no new important provisions.

The new Code is, on the whole, somewhat more elastic than the present one. Its greater value will largely be determined by the spirit in which it is administered. The work of the inspectors will not be lightened, and their power and responsibility will be greatly increased. The allowance to be made for the 'circumstances' of any given school will require a judgment which will apprehend more than the mere mechanical results of examinations or the poverty of the neighbourhood. If school boards and managers generally will sympathise with the generous spirit in which this 'Minute' has been conceived, and if the inspectors will liberally interpret its

articles, the 'Mundella Code' may tend to relieve the injurious pressure now put upon weakly children, and will deserve a nation's gratitude. But if the administration of the Code is harsh, and a high 'percentage' continues to be in the eyes of managers the measure of a teacher's success, children will still be deprived of their natural joy, and most of the evils of the present Code will be intensified. *Meliora speramus.*

The 'Practical Teacher' Writing Competition.

AWARD OF PRIZES.

FIRST YEAR—MALES.

CARACTACUS.

James M. Wallace, 2, British Terrace, Dyffryn, Merioneth.
Other competitors:—Salt, Red Hand, Cymro Pur, Acanthus, T. Scribo, Standard, Tonyquat, Samivel.

FIRST YEAR—FEMALES.

PONTOP PIKE.

Lydia Wilkinson, West Kyo Board School, Lintz Green.
Other competitors:—Forward, Moorlands, Dark-eyed Gipsy, Lilian Leigh, Mayflower, Athenè, Excelsior, Hope.

SECOND YEAR—MALES.

INTEGER.

James Ashworth, 53, Whit Lane, Pendleton, Manchester.
Other competitors:—Cymro Bach, Excelsior, Naïveté, N.A., A.L., Heston, Pilgrim, Achilles, The Craigs, Labor omnia vincit, Bonnie Doon.

SECOND YEAR—FEMALES.

SUNFLOWER.

Jemima Blackburn, Ryan Street Board School, Bradford.
Other competitors:—Mephistopheles, Merry May, Honesty, Ironlands, Florence Ada, Harriet Frarey, Queen Elizabeth, Hypatia, Jenny Wren.

THIRD YEAR—MALES.

PAPYRUS.

John H. Scott, 760, Scotswood Road, Newcastle-on-Tyne.
Other competitors:—St. Keverne, Iroquois, Fair Play No. 1, Chas. Dickens, Dudley, Fitzroy W. George, Beta, Pupil, Netherton, George False, Philyra, Wendreda.

THIRD YEAR—FEMALES.

HOME.

Mary J. Best, Charlwood Road School, Putney.
Other competitors:—Aurora, Hyacinth, Excelsior, Stella, Fanny Fern, Emmie, Excelsior II.

FOURTH YEAR—MALES.

CHARLEMAGNE.

John W. Humphrey, West Kyo Board School, Lintz Green.
Other competitors:—Rienzi, Dewi Sant, Unique, Euphonia, Nomen, Excelsior, Anxious, Lol.

FOURTH YEAR—FEMALES.

HOLLY BERRY.

Annie Batts, Billesdon, Leicestershire.
Other competitors:—Italia, Mona Bouquet, Happy Jack, Nil Desperandum, Galanthus, Annie Laurie, Eulalia, Hopewell, Dorothy, Xantippe, Effie, Manlia.

W. T. GREENUP, Judge.

*** The letters or stories for the competition based on Dr. Carpenter's 'Health at School' must reach the Office not later than May 31st.

Publications Received.

Classics—
(1) Müller's Hebrew Syntax. Maclehose and Sons.
(2) Conington's Translation of Virgil. Longmans & Co.
(3) Cambridge Texts, with Notes. Bell & Son.

English Literature—
(1) Macaulay's Lays of Rome. Longmans & Co.

Geography—
(1) Mason's Geographical Reader, Book II. for Standard III. Stanford.
(2) Geography Reading Books. National Society.

Grammar—
(1) Kent's Parser's Companion. Bird.
(2) Meiklejohn's Standard Grammar. W. & R. Chambers.

History—
(1) English History Home-Lesson Books. National Society.
(2) First Historical Reader. Isbister.
(3) Second Historical Reader. Isbister.

Mathematics—
(1) Bain and Prince's Rapid Computation in Mental Arithmetic. T. Murby.

Miscellaneous—
(1) Chambers' Etymological Dictionary (New Edition). W. & R. Chambers.
(2) Barker's Rhyme of English Sovereigns. T. Murby.
(3) Odom's Types and Shadows of the Old Testament. Nisbet & Co.

Periodical Literature—
(1) Our Little Ones. Griffith and Farran.
(2) Oxford Examiner, No. 2. Stanford.
(3) Cambridge Examiner. Stanford.

Prize Books—
(1) Little Daniel. Blackie & Sons.
(2) Prince Alexis. ,, ,,
(3) Sasha the Serf. ,, ,,

Science—
(1) Wormell's Electricity and Magnetism. T. Murby.
(2) Bradlaugh's (H.) Chemistry of Home. 28, Stonecutter Street.

Engagements for April.

April	1.	Sth. Midland Dist. Union Ann. Meeting.	
,,		Leicestershire School Association Meeting.	
,,	3.	Last day of Issue of N.U.E.T. Agenda to Representatives	
,,	4.	Teachers' Investment Society Meeting	
,,	5.	Geological Society	8 p.m.
,,		Parliamentary and Law Committee, N.U.E.T.	
,,	6.	Linnean Society	8 p.m.
,,	7.	Press Committee, N.U.E.T.	
,,	8.	Executive Meeting, N.U.E.T.	
,,	10.	Opening Sheffield Conf., N.U.E.T.	
,,	12.	Anthropological Society	8 p.m.
,,	13.	Metropolitan Board Teachers' Association Monthly Committee	
,,	15.	Last day for Science and Art Form 325	
,,	19.	Parliamentary and Law Committee, N.U.E.T.	
,,	20.	Linnean Society	8 p.m.
		Royal Society	4.30 p.m.
,,	21.	Executive Meeting, N.U.E.T.	
,,	22.	East Kent P.T. Examination	
,,	24.	Royal Geographical Society	8.30 p.m.
,,	26.	Anthropological Society	8 p.m.
		Geological Society	8 p.m.
,,	27.	Royal Society	4.30 p.m.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher
Pilgrim Street, Ludgate Hill,
London, E.C.

Algebra.

1. J. R. D., Wigan.—There are three equal vessels A, B, C; the first contains water, the second brandy, and the third brandy and water. If the contents B and C be put together, it is found that the fraction obtained by dividing the quantity of brandy by the quantity of water, is nine times as great as if the contents of A and C had been treated in like manner. Find the proportion of brandy to water in vessel C.

Let x = quantity of water in A, and brandy in B,
And y = " " brandy in C;
Then $x-y$ = " " water " "

$$\therefore \frac{x+y}{x-y} = \frac{y}{x+x-y} \times 9$$

$$= \frac{9y}{2x-y}$$

$$2x^2 + xy - y^2 = 9xy - 9y^2$$
$$2x^2 - 8xy + 8y^2 = 0$$
$$x^2 - 4xy + 4y = 0$$
$$x - 2y = 0$$
$$\therefore x = 2y.$$

The quantity of brandy in B is double the quantity in C.
∴ Brandy and water are equal in C.

2. Solve:— $\frac{1+x^3}{(1+x)^2} + \frac{1-x^3}{(1-x)^2} = a$. (*Barnard Smith.*)

$$\frac{1+x^3}{(1+x)^2} + \frac{1-x^3}{(1-x)^2} = a$$

$$\frac{1-x+x^2}{1+x} + \frac{1+x+x^2}{1+x} = a$$

$$\frac{1-2x+2x^2-x^3+1+2x+2x^2+x^3}{1-x^2} = a$$

$$\frac{2+4x^2}{1-x^2} = a$$

$$2+4x^2 = a-ax^2$$
$$ax^2+4x^2 = a-2$$
$$(a+4)x^2 = a-2$$
$$x^2 = \frac{a-2}{a+4}$$
$$\therefore x = \pm\sqrt{\frac{a-2}{a+4}}.$$

3. GLACIER.—A railroad runs from A to C. A goods train starts from A at 12 o'clock, and a passenger train at 1 o'clock. After going two-thirds of the distance, the goods train breaks wn, and can only travel at three-fourths of its former rate. At forty minutes past 2 o'clock a collision occurs, 10 miles from C. The rate of the passenger train is double the diminished rate of the goods train. Find the distance from A to C, and the rates of the trains.

Let x = distance in miles between A and C,
And y = rate per hour of goods train before break-down;
Then $\frac{3y}{4}$ = " " after "
And $\frac{3y}{4} \times 2$ or $\frac{3y}{2}$ = " passenger train " "

$$\therefore \text{(1)} \left(\frac{2x}{3} \div y\right) + \left\{\left(\frac{x}{3} - 10\right) \div \frac{3y}{4}\right\} = 2\tfrac{2}{3}$$
$$\text{(2)} \; (x-10) \div \frac{3y}{2} = 1\tfrac{2}{3}$$

$$\text{(1)} \; \frac{2x}{3y} + \frac{4(x-30)}{9y} = \frac{8}{3}$$
$$\text{(2)} \; \frac{2(x-10)}{3y} = \frac{8}{3}$$

(1) $6x + 4x - 120 = 24y$
(2) $2x - 20 = 5y$
(1) $10x - 120 = 24y$
(2) $10x - 100 = 25y$
$-20 = -y$
$\therefore y = 20.$
$2x - 20 = 5y$
$2x = 100 + 20$
$\therefore x = 60.$

∵ Distance from A to C = 60 miles
Rate of goods train = 20 "
" passenger " = 30 " } Ans.

4. E. G. T., Bangor.—Two trains, 92 and 84 feet respectively, when moving with uniform velocities on parallel rails in opposite directions, pass each other in $1\frac{1}{2}$ seconds; but when they move in the same direction, the faster passes the other in five seconds; find the rates of speed.

Let x = rate per second of faster train in feet,
and y = " " other "

Then, $1\frac{1}{2}(x+y) = 62+84$
$5(x-y) = 92+84$
$3(x+y) = 352$
$5(x-y) = 176$
$x+y = 117\frac{1}{3}$
$x-y = 35\frac{1}{5}$

Adding, $2x = \frac{1760+528}{15}$

$= \frac{2288}{15}$

$\therefore x = \frac{1144}{15}$.

Subtracting, $2y = \frac{1760-528}{15}$

$= \frac{1232}{15}$

$\therefore y = \frac{616}{15}$.

Rate of faster train per hour $= \left(\frac{\cancel{77}\cancel{44}}{\cancel{7}\cancel{8}} \times \frac{\cancel{8}\cancel{\phi}}{1} \times \frac{\cancel{8}\cancel{\phi}}{1} \times \frac{1}{\cancel{8}\cancel{7}\cancel{8}\cancel{\phi}}\right)$ $\frac{\cancel{8}\cancel{8}}{22}$ mls.

$= 52$ miles.

„ other „ „ $= \frac{616}{22}$ mls.

$= 28$ miles.

5. DISCIPULUS.—Find the coefficient of x in the following expansion:—

$(x^2 - mx + 1)(x^2 - nx - 1)(x^4 - m^2x1)$. (*Hamblin Smith.*)

$(x^2 - mx + 1)(x^2 - nx - 1)(x^4 - m^2x - 1)$

$= \{(x^2 - mx) + 1\}\{(x^2 - nx) - 1\}(x^4 - m^2x - 1)$

$= \{(x^2 - mx)^2 - 1\}(x^4 - m^2x - 1)$;

The only term involving $x = -1 \times -m^2x = m^2x$,

$\therefore$ coefficient of $x = m^2$.

6. NERO, Pontypridd.—If $4x^4 + 12x^3y + 2x^2y^2 + 6xy^3 + y^4$ be a perfect square, find 2. (Stewart's 'Exercises in Algebra.')

$4x^4 + 12x^3y + 2x^2y^3 + 6xy^3 + y^4 \left(2x^2 + 3xy + y^2\right.$

$4x^4$

$4x^2 + 3xy \mid 12x^3y + 2x^2y^2$

$12x^3y + 9x^2y^2$

$4x^2 + 6xy + y^2 \mid (2-9)x^2y^2 + 6xy^3 + y^4$

$4x^2y^2 + 6xy^3 + y^4$

$\therefore$ 2 − 9 must equal 4,

$\therefore$ 2 = 13. Ans.

7. N. E. S., Sheffield.—Given

$au + (a+p-x)y + cz = 0$,

$bu + (b+q-x)y + bz = 0$,

$cu + (c+r-x)y + az = 0$;

Show that x is independent of y, z, and u, and find its value. (Science and Art, 1881.)

(1) $au + (a+p-x)y + cz = 0$

(2) $bu + (b+q-x)y + bz = 0$

(3) $cu + (c+r-x)y + az = 0$

(1) $\times b$, $abu + b(a+p-x)y + bcz = 0$

(2) $\times a$, $abu + a(b+q-x)y + abz = 0$

Subtracting, $b(p-x)y - a(q-x)y + b(c-a)z = 0$ (4)

(2) $\times c$, $bcu + c(b+q-x)y + bcz = 0$

(3) $\times b$, $bcu + b(c+r-x)y + abz = 0$

Subtracting, $c(q-x)y - b(r-x)y + b(c-a)z = 0$ (5)

$\therefore b(p-x)y - a(q-x)y = c(q-x)y - b(r-x)y$

$b(p-x) - a(q-x) = c(q-x) - b(r-x)$

$bp - bx - aq + ax = cq - cx - br + bx$

$ax + cx - 2bx = aq + cq - bp - br$

$(a+c-2b)x = q(a+c) - b(p+r)$

$\therefore x = \frac{q(a+c) - b(p+r)}{a+c-2b}$

Arithmetic.

1. R. B.—A person rows a distance of 1½ miles *down* a stream in 20 minutes, but without the aid of the stream it would have taken him half-an-hour; what is the rate of the stream per hour, and how long would it take him to return against it? (Barnard Smith.)

With the aid of the stream, he rows 1½ miles in 20 minutes, that is, 4½ miles an hour;

Without the aid of the stream, he rows 1½ miles in ½ hour, that is, 3 miles an hour;

$\therefore$ Rate of stream = (4½ − 3) miles an hour.

= 1½ miles an hour. Ans.

Against the stream, he rows (3 − 1½) miles or 1½ miles an hour.

$\therefore$ Against the stream, it would have taken him 1 hour. Ans.

2. POMPEY.—A farm is let for £96 and the value of a certain number of quarters of wheat. When wheat is 38s. a quarter, the whole rent is 15 per cent. lower than when it is 56s. a quarter. Find the number of quarters of wheat which are paid as part of the rent. (Barnard Smith.)

Difference of (56s. − 38s.) or 18s. in the price of wheat makes a difference of 15 per cent. on the whole rent, when wheat is 56s. a quarter.

$\therefore$ (No. of qrs. × 18)s. = $\frac{3}{20}$ of [£96 + (No. of qrs. × 56)s.]

= $\frac{3}{20}$ of £96 + $\frac{3}{20}$ of (No. of qrs. × 56)s.

= 288s. + (No. of qrs. × $\frac{3}{20}$ of 56)s.

= 288s. + (No. of qrs. × 8½)s.

(No. of qrs. × 18)s. − (No. of qrs. × 8½)s. = 288s.

(No. of qrs. × 9½)s. = 288s.

$\therefore$ No. of qrs. = $\frac{288\text{s.}}{9\frac{1}{2}\text{s.}}$

$= \frac{1440}{48}$

= 30. Ans.

3. J. P.—At 4½ %, for what sum should goods be insured, which are worth £427 15s. 3d., in order that in case of loss their owner may recover their value, together with the premium paid?

£

100

$4\frac{1}{2}$

$95\frac{1}{2}$: 427 15 3 :: £$\phi\phi$: sum to be insured.

8 8 20

$7\phi\phi$ 3422 2 0

153 20 £ s. d.

68442 0 0 447 6 8 Ans.

612

724

612

1122

1071

51

20

1020 6s.

918

102

12

1224 8d.

1224

4. JONO BIGGS.—I give 5 guineas for 2 dozen of wine at different rates per dozen; and by selling the cheaper kind at a profit of 20 per cent., and the dearer at a loss of 10 per cent., I obtain a uniform price for both. What does each dozen cost me?

Cost of 1 doz. of cheaper wine at 20% increase = cost of 1 doz. of dearer wine at 10% decrease;

Cost of 1 doz. of cheaper wine at $\frac{8}{10}$ of original price = cost of 1 doz. of dearer wine at $\frac{9}{10}$ of original price;

Cost of $\frac{8}{9}$ doz. of cheaper wine = cost of $\frac{8}{10}$ doz. of dearer wine;

$\therefore$ Cost of 1 doz. of cheaper wine = cost of $\frac{8}{9}$ of $\frac{8}{10}$ doz. of dearer wine

= cost of $\frac{4}{5}$ doz. of dearer wine.

Cost of 1 doz. of dearer wine + cost of 1 doz. of cheaper wine = 5 guineas;

$\therefore$ Cost of 1$\frac{4}{5}$ doz. of dearer wine = 5 guineas;

Cost of 1 doz. of dearer wine = 5 guineas ÷ 1$\frac{4}{5}$

= $\frac{5}{9}$ of 5 guineas

= £3;

And cost of 1 doz. of cheaper wine = £2 5s. } Ans.

5. YELSERP.—Riding a journey of 27 miles into town, I meet the coach, which left town at the same moment that I started from home (7 o'clock), at the 18th milestone from town. Supposing that it travels 10 miles an hour, determine the hour when we meet, and the time when (proceeding at the same rate as before) I shall reach London.

Coach travels 18 miles in $\frac{18}{10}$ hrs.

= 1$\frac{4}{5}$ hrs.

= 1 hr. 48 min.

$\therefore$ Time when they meet = 48 min. past 8.

= 12 min. to 9. Ans.

I ride at the rate of (27 − 18) miles or 9 miles in 1 hr. 48 min.
∴ I shall reach London in 1 hr. 48 min. × 3
= 5 hrs. 24 min.
= 24 min. past 12. Ans.

6. SUBSCRIBER. – With a gallon of rum which cost 15s. a man mixes a quart of water, and then sells it for 16s. a gallon; with a gallon of gin at 11s. he mixes 2½ pints of water, and sells it at 12s. a gallon; and with a gallon of brandy which cost 22s. he mixes 3 pints of water, and then sells it for 23s. a gallon: how much does he gain per cent., supposing him to sell twice as much rum as gin, and twice as much gin as brandy? – (*Barnard Smith.*)

Cost of 1 gallon of rum, as sold = 15s. × ⅘ = 12s.
,, ,, 1 ,, ,, gin, ,, = 11s. × $\frac{8}{10\frac{1}{2}}$
= $\frac{176}{21}$s.
= $8\frac{8}{21}$s.
,, ,, 1 ,, ,, brandy ,, = 22s. × $\frac{8}{11}$
= 16s.
Gain on 1 gal. of brandy, cost 16s. = 7s.
,, ,, 2 gals. of gin, cost $16\frac{8}{21}$s. = $7\frac{8}{21}$s.
,, ,, 4 ,, ,, rum, ,, 48s. = 16s.
Gain on $80\frac{8}{21}$s. = $30\frac{8}{21}$s.
,, ,, $\frac{1680}{21}$s. = $\frac{638}{21}$s.
25
∴ Gain p.c. = $\frac{635 \times 100}{1680}$
424
= $\frac{3487.5}{1234}$
= $37\frac{187}{424}$. Ans.

7. THOMAS JONES.—A farmer gave for a horse a bill for £73 due in one month, and sold it immediately for a bill for £87 at 4 months. Find his gain per cent., interest being at the rate of 4½ per cent.

£100 : £73 :: £100 : present worth of 1st bill.
8
$\frac{800}{11}$ = $\frac{800}{11}$£.
£101½ : £87 :: £100 : present worth of 2nd bill.
$\frac{203}{2}$ = $\frac{17400}{203}$£.
Gain = $(\frac{17400}{203} - \frac{8000}{11})$£
= $\frac{191400 - 162400}{2233}$£
= $\frac{29000}{2233}$£
3265
∴ Gain p.c. = $\frac{29000}{2233} \times \frac{100}{1} \times \frac{11}{8000}$
203
= $\frac{3809.5}{203}$
= $17\frac{174}{406}$. Ans.

8. MARY.—A person leaves £12,670 to be divided among his five children and three brothers, so that, after the legacy duty has been paid, each child's share shall be twice as great as each brother's. The legacy duty on a child's share being 1 per cent., and on a brother's 3 per cent., find what each will receive.

(100 − 1) × (100 − 3) = 99 × 97 = 9603.
Suppose a brother receives £9603,
And ,, child ,, £19206;
Then amount left to a brother = £9603 × $\frac{100}{97}$
= £9900,
And ,, ,, child = £19206 × $\frac{100}{99}$
= £19400;
Then ,, the brothers = £9900 × 3
= £29700,
And ,, children = £19400 × 5
= £97000;
Then total amount left = £29700 × £97000
= £126700.
£ £ £
∴ 126700 : 12670 :: 9603 : Amount left to a brother.
= £960 6s.
Amount left to a child = £1920 12s.
,, ,, brother = £920 6s. } Ans.

9. ALICE.—A bill of £649 is dated on June 23rd, 1853, at six months, and is discounted on July 8th, at 3½ per cent.; what does the banker gain thereby?
Bill is due on Dec. 26th.

No. of days from July 8th to Dec. 26th = 171.

£
649
3½
1947
162 5s.
£21·09 5s.
20
s. 1·85
12
d. 10·20.

Days Days £ s. d.
∴ 365 : 171 :: 21 1 10½ : Banker's discount
171
365 | 3606 16 4½
£9 17 7$\frac{1100}{1825}$

$\frac{171}{365}$ of 3½ = $\frac{2223}{1460}$£ = $1\frac{763}{1460}$£.
£ £ £
∴ $101\frac{763}{1460}$: 649 :: $1\frac{763}{1460}$: True discount.
1460 1460
148223 2223
649
148223 | 1442727
£9 14s. $8\frac{8888}{148223}$d.

Banker's gain = £9 17s. $7\frac{1100}{1825}$d. – £9 14s. $8\frac{8888}{148223}$d.
= 2s. 11½d. Ans.

10. ALPHA, Edington.—If the 3 per cents. are at 95, and Government offer to receive tenders for a loan of £5,016,000, the lender to receive five millions in the 3 per cents., together with a certain sum in the 3½ per cents., what sum in the 3½ per cents. ought the lender to accept?

Value of stock in the 3 per cents. = £(95 × 50,000)
= £4,750,000;
∴ ,, ,, 3½ ,, = £5,016,000 − £4,750,000
= £266,000.
Value of 3½ per cent. stock = £95 × $\frac{3\frac{1}{2}}{3}$
= £95 × $\frac{7}{6}$
= £$\frac{665}{6}$;
∴ Amount of 3½ per cent. stock = £(266,000 ÷ $\frac{665}{6}$)
= £$\frac{266,000 \times 6}{665}$
= £240,000. Ans.

11. B.O.Y.—A house cost three times as much for materials as for labour. Had the materials cost 7½ per cent. more, and the labour 5 per cent. less, the house would have cost £2087 10s. What was its cost?

Suppose the labour cost £100,
Then the materials ,, £300;
∴ Cost of the house = £400.
Cost of labour if decreased 5 per cent. = £95,
Cost of materials if increased 7½ per cent. = £300 + £7½ × 3
= £322½;
∴ Cost of house = £95 + £322½
= £417½.
∴ £417½ : £2087½ :: £400 : cost of house
2 2
835 4175
5
= £2000. Ans.

12. G. G., Forton.—Three boys were sent to sell oranges. The first boy had fifty oranges, the second had 30, and the third had 10. They were all to sell at the *same price*, and to bring back the same amount of money. How was it done?

If the oranges were sold *at first* at 7 a penny,
The first boy would have 7d., and 1 orange left,
,, second ,, ,, ,, 4d., ,, 2 oranges ,,
,, third ,, ,, ,, 1d., ,, 3 ,, ,,
Now, if the remaining oranges were sold at 3d. each,
The first boy would have 7d. + 3d. = 10d.
,, second ,, ,, ,, 4d. + 6d. = 10d.
,, third ,, ,, ,, 1d. + 9d. = 10d.

13. HYACINTH.—Halfpenny post-cards are sold on an average at 7½d. per dozen. If the cards can be procured from the manufacturer at 7s. 6d. per 1000, what is the gain per cent. to Government *over and above* the postage?

Selling price per dozen, deducting postage = 1½d.
,, ,, ,, thousand, ,, ,, = 1½d. × $\frac{1000}{12}$
= 10s. 5d.
Gain per thousand = 10s. 5d. – 7s. 6d.
= 2s. 11d.

s. d. £ s. d.
∴ 7 6 : 10$\not{9}$ :: 2 11 : Gain per cent.
$\frac{12}{9\not{9}} \cdot \frac{12}{35}$
$= \frac{350}{9}$
$= 38\dot{8}$. Ans.

14. ALPHA, Tring.—A and B engage in business, their capitals being as 7 : 11. At the end of three months A withdraws $\frac{1}{3}$ of his capital, and one month afterwards B adds twice what A had withdrawn. How should a profit of £337 7s. 6d. be divided at the end of the year?

If 7 stand for A's capital, then 11 stands for B's. Then proportionately,

A's capital $= 7 \times 3 + (\frac{2}{3}$ of $7 \times 9)$
$= 21 + 42$
$= 63$;
B's capital $= 11 \times 12 + (\frac{2}{3}$ of $7 \times 8)$
$= 132 + 37\frac{1}{3}$
$= 169\frac{1}{3}$;
$63 + 169\frac{1}{3} = 232\frac{1}{3}$.

£ s. d.
∴ $232\frac{1}{3}$: 63 :: 337 7 6 : A's share
3 3 189
697 189

697 | 63763 17 6
£91 9 $7\frac{189}{697}$
£ s. d.
∴ A's share = 91 9 $7\frac{189}{697}$
B's ,, = 245 17 $10\frac{508}{697}$ } Ans.

15. KAPPA, Weston-super-Mare.—A man spends every year one-tenth of his income, and invests the rest in annuities at the rate of £90 for every annuity of £3; supposing his income £1,000 a year to begin with, what will it be at the end of four years?

Income at the end of 2nd year $= £1000 + \frac{1}{10}$ of £900.
$= £1030$;
,, ,, 3rd ,, $= £1030 + \frac{1}{10}$ of $\frac{9}{10}$ £1030
$= £1030 + 30{\cdot}9$
$= £1060{\cdot}9$;
,, ,, 4th ,, $= £1060{\cdot}9 + \frac{1}{10}$ of $\frac{9}{10}$ of £1060.9
$= £1060{\cdot}9 + £31{\cdot}827$
$= £1092{\cdot}727$
$= £1092$ 14s. $6\frac{12}{25}$d. Ans.

Mensuration.

1. DEWI.—Find the volume of the largest sphere which can be turned from a block (cubical) of wood containing 7 cubic feet and 71 cubic inches.

Diameter of sphere $= \sqrt[3]{7 \text{ cub. ft. } 71 \text{ in.}}$
Volume of sphere = Diameter$^3 \times {\cdot}5236$
= 7 cub. ft. 71 in. $\times {\cdot}5236$
$= \frac{1309}{2500}$ of 7 cub. ft. 71 in.
$= \frac{9216 \text{ cub. ft. } 1355 \text{ in.}}{2500}$
$= 3$ cub. ft. 1186 $\frac{1000}{2500}$ in. Ans.

2. HEN SAIS.—A right pyramid, 12 ft. high, stands on a square base, of which the sides are each 10 ft.; find (1) the volume of the pyramid, (2) the area of one of its triangular faces, and (3) the position of a plane parallel to the base, which divides it into two equal parts.

(1) Volume of pyramid = $\frac{1}{3}$ Area of Base × Height
$= (\frac{1}{3} \times 10^2 \times 12)$ cub. ft.
= 400 cub. ft. Ans.

(2) Length from apex to middle of side of base $= \sqrt{12^2 + 5^2}$
$= \sqrt{169} = 13$ ft.
Area of a triangular face = $\frac{1}{2}$ side of base × slant height
$= (\frac{1}{2} \times 10 \times 13)$ sq. ft.
= 65 sq. ft.

(3) Volume of each part = 200 cub. ft.
Volume of upper half = $\frac{1}{3}a^2h$,
,, ,, lower ,, $= \frac{12-h}{3}(a^2 + ab + b^2)$,
where h = height of upper half, a^2 and b^2 = areas of ends, l^2 being area of base.

$\therefore 200 = \frac{1}{3}a^2h$
$200 = \frac{12-h}{3}(a^2 + ab + b^2)$ }
$600 = a^2h$
$600 = (12-h)(a^2 + 10a + 100)$ }
$600 = a^2h$
$600 = 12a^2 + 120a + 1200 - a^2h - 10ah - 100h$ }
$600 = a^2h$
$-600 = -a^2h + 12a^2 + 120a - 10ah - 100h$ }

Adding, $0 = 12a^2 + 120a - 10ah - 100h$
$12a^2 + 120a = 10ah + 100h$
$12a(a + 10) = 10h(a + 10)$
$12a = 10h$
$6a = 5h$
$\therefore a = \frac{5h}{6}$.
$600 = a^2h$
$= \left(\frac{5h}{6}\right)^2 \times h$
$= \frac{25h^3}{36}$
$h^3 = 24 \times 36$
$= 864$
$h = \sqrt[3]{864}$
$= 9{\cdot}52\ldots$

∴ Position of plane parallel to base
= (12 — 9·52...) ft. from base
= 2·47... ft. from base. Ans.

3. JUMBO.—A field, the shape of an equilateral triangle, contains half an acre. What length of cord, by which a horse is tied at one corner, will allow him to graze on half the field?

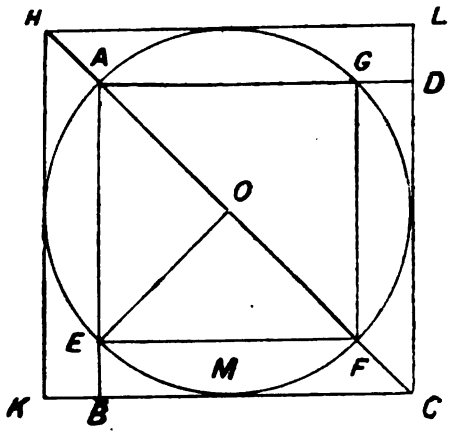
Area of part grazed by horse = $\frac{1}{2}$ acre = 1,210 yards. Now this part is the segment of a circle, of which the cord is the radius; the angle of the segment = 60°, the triangle being equilateral;

∴ Area of circle = 1210 yds. × 6 = 7260 yds.
,, ,, = Radius$^2 \times 3{\cdot}1416$;
∴ Radius$^2 \times 3{\cdot}1416$ = 7260 yds.
Radius^2 = 7260 yds. ÷ 3·1416
= 2310·923...yds.
∴ Radius = $\sqrt{2310{\cdot}923\ldots}$yds.
= 48·07...yds.
∴ Length of cord = 48·07...yds. Ans.

4. ENQUIRER.—A stone pillar, in shape a cylinder of 3 fee diameter, with the top rounded into a hemisphere, is found to weigh exactly twice as much as a sphere made of the same sort of stone and of 6 ft. diameter. What is the height of the pillar? (*Civil Service Examination.*)

Volume of sphere = Diameter$^3 \times {\cdot}5236$
$= 6^3 \times {\cdot}5236$
$= 216 \times {\cdot}5236$;
∴ ,, ,, pillar $= 432 \times {\cdot}5236$.
,, ,, cylinder = Area of base × Height
$= 3^2 \times {\cdot}7854 \times$ Height
$= 9 \times {\cdot}7854 \times$ Height;
,, rounded top = $3^3 \times {\cdot}5236 \div 2$
$= \frac{27}{2} \times {\cdot}5236$.
∴ $9 \times {\cdot}7854 \times \text{Height} + \frac{27}{2} \times {\cdot}5236$
$= 432 \times {\cdot}5236$
$9 \times {\cdot}7854 \times \text{Height} = (432 - \frac{27}{2}) \times {\cdot}5236$
$= 837 \times {\cdot}2618$
$\frac{837}{9\not{3}}$
$\frac{9\not{3}}{3}$
∴ Height of cylinder $= \frac{8\not{3}7 \times 2\not{6}18}{9 \times 7\not{8}\not{5}\not{4}}$
$= 31$ ft.
∴ Height of pillar = 31 ft. + height of rounded top
= 31 ft. + $1\frac{1}{2}$ ft.
= $32\frac{1}{2}$ ft. Ans.

5. J. HESLOP, Aldoth.—On the diagonal AC of the square ABCD describe a circle passing through the angle A and touching the sides BC and CD. The diagonal of the square equals $\sqrt{128}$. Required the area common to the two figures.



$2AB^2 = AC^2 = 128$; $\therefore AB = 8$.

$AE = 8 - BE$; and $HK = 8 + BE$.

Diameter of circle = side of circumscribed square;

$\therefore AF = HK = 8 + BE$

$AF^2 = (8 + BE)^2$;

But $AF^2 = 2AE^2 = 2(8 - BE)^2$;

$\therefore 2(8 - BE)^2 = (8 + BE)^2$

$2(64 - 16BE + BE^2) = 64 + 16BE + BE^2$

$128 - 32BE + 2BE^2 = 64 + 16BE + BE^2$

$BE^2 - 48BE = -64$

$BE^2 - 48BE + (24)^2 = 576 - 64$

$= 512$

$BE - 24 = \pm 16\sqrt{2}$

$\therefore BE = 24 - 16\sqrt{2}$

$= 8(3 - 2\sqrt{2})$.

Area of segment EMF = Area of sector OEMF − area of triangle EOF

$= \frac{1}{4}$ area of circle $- \frac{EO^2}{2}$

$= \frac{1}{4}(AF^2 \times \cdot 7854) - \frac{EF^2}{4}$

$= \frac{1}{4}\{8 + 8(3 - 2\sqrt{2})\}^2 \times \cdot 7854 - \frac{1}{4}\{8 - 8(3 - 2\sqrt{2})\}^2$

$= \frac{1}{4}[\{16(2 - \sqrt{2})\}^2 \times \cdot 7854 - \{16(\sqrt{2} - 1)\}^2]$

$= \frac{1}{4}\{256(6 - 4\sqrt{2}) \times \cdot 7854 - 256(3 - 2\sqrt{2})\}$

$= \frac{1}{4}\{256(3 - 2\sqrt{2})(2 \times \cdot 7854 - 1)\}$

$= 64(3 - 2\sqrt{2}) \times \cdot 5708$.

Area of common part $= EF^2 + \{64(3 - 2\sqrt{2}) \times \cdot 5708 \times 2\}$

$= 256(3 - 2\sqrt{2}) + \{128(3 - 2\sqrt{2}) \times \cdot 5708\}$

$= 128(3 - 2\sqrt{2})(2 + \cdot 5708)$

$= 256(\frac{5}{4} - \sqrt{2}) \times 2 \cdot 5708$

$= 658 \cdot 1248(1 \cdot 5 - 1 \cdot 4142\ldots)$

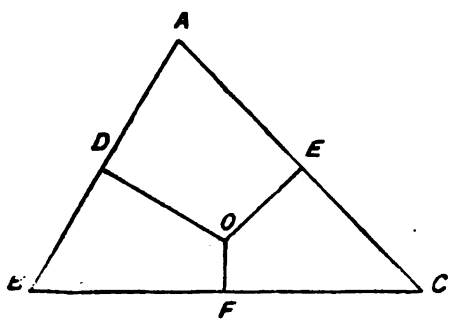
$= 658 \cdot 1248 \times \cdot 0857\ldots$

$= 56 \cdot 40129376\ldots$ Ans.

Geometry.

1. BETA.—The three perpendiculars drawn from the middle points of the sides of a triangle intersect in one point.

Let ABC be a triangle, and let D, E, F be the middle points of the sides.



Then the perpendiculars drawn from D, E, F shall intersect in one point.

At D, E drawn DO, EO at right angles to AB, AC, respectively (I. 11), and join OF.

Then FO shall be at right angles to BC.

Join OA, OB, OC.

Proof.—In the triangles OAD, OBD, the sides OD, DA are equal to the sides OD, DB, each to each, and the angle ODA is equal to the angle ODB (Ax. 11); therefore the base OA is equal to the base OB. (I. 4.) Similarly it can be proved that OA is equal to OC; therefore OB is equal to OC. (Ax. 1.)

In the triangles OBF, OCF, the two sides BF, FO are equal to the two sides CF, FO, each to each, and the base OB is equal to the base OC; therefore the angle OFB is equal to the angle OFC. (I. 8.)

Wherefore FO is at right angles to BC. (Def. 10.)

Therefore the three perpendiculars intersect in one point.

Q.E.D.

2. P. T.—Let A, B, C, D be four points in a straight line taken in order. Show that the rectangle AC, BD is equal to the sum of the rectangles AB.CD, and AD.BC.

A B C D

Rect. AC.BD = rect. AB.BD + rect. BC.BD.

= rect. AB.CD + rect. AB.BC.

+ rect. BC.BD.

= rect. AB.CD × rect. AD.BC.

(II. 1.) Q. E. D.

3. ELIZABETH PRINCE.—You must have made an error in the deduction, as it can be proved that $BC^2 = AC.CP - AB.BQ$.

General.

1. DIEU ET MON DROIT.—The 'Code' contains the following in a foot-note:—

'This grant should be divided between the teacher and pupil teachers in such proportion as the managers may determine.'

The teacher generally receives two-thirds, and the pupil-teacher one-third.

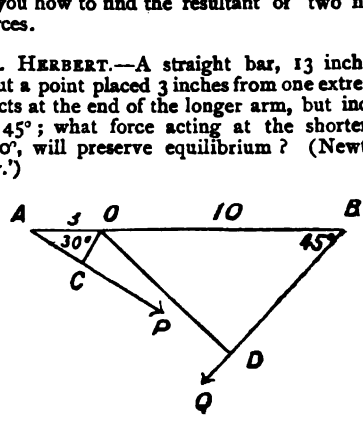
There is plenty of room for improvement in your writing. Thanks for questions.

2. PUPIL TEACHER. — The Schedule for Pupil Teachers notifies:—'The language paper will contain grammatical questions, and easy passages for translation into English.'

3. N. W. H.—Candidates may obtain marks at the Scholarship Examination for one of the following subjects: Mechanics; Chemistry; Animal Physiology; Acoustics, Light and Heat; Magnetism, Electricity; Physiography; Botany. Marks will only be given for a first-class in the elementary stage, or a pass in the advanced stage.

4. E. CROSS, Faversham. — Any text-book on Mechanics will show you how to find the resultant of two non-concurrent parallel forces.

5. C. H. HERBERT.—A straight bar, 13 inches in length moves about a point placed 3 inches from one extremity; a force of 30 lbs. acts at the end of the longer arm, but inclined to it at at angle of 45°; what force acting at the shorter arm, at an angel of 30°, will preserve equilibrium? (Newth's 'Natural Philosophy.')



P × perpendicular OC = Q × perpendicular OD.

But $\frac{OC}{OA} = \sin OAC = \sin 30°$,

$\therefore OC = OA \sin 30°$;

And OD = OB sin 45°.

$$\therefore P \times OA \sin 30° = Q \times OB \sin 45°$$

$$P \times 3 \times \tfrac{1}{2} = 30 \times 10 \times \frac{1}{\sqrt{2}}$$

$$P = 10 \times 10 \times 2 \times \frac{1}{\sqrt{2}}$$

$$= 100\sqrt{2}$$

$$(\sqrt{2} = 1{\cdot}4142\ldots)$$

$$\therefore P = 141{\cdot}42\ldots \text{lbs.}$$ Ans.

6. EAST ANGLIA.—Write to the Registrar of London University.

7. NORTH.—Scripture is not taken at the Scholarship Examination.

8. PRECEPTOR.—The letter which obtained the prize will appear in next issue.

9. W. JAMES.—Fellow of the Statistical Society.

10. NELSON.—

11. LONGITUDE and LATITUDE.—

12. &.—

13. BOY BLUE, Hull.—

14. CYMRO.—You could not have a much better book than the one you mention. You might buy 'The Student's Hume' (*Murray*, 7s. 6d.), or 'Curtis' (*Simpkin and Co.*, 5s.)

15. UTOR NON ABUTOR.—Fraction from the Latin *frangere*, to break.

Writing decimal fractions is only an extension of our system of writing whole numbers. Thus:—$100 = 10^2$; $\cdot 01 = \frac{1}{100} = \frac{1}{10^2} = 10^{-2}$.

If a number be expressed in the common scale, and the number be an *integer*, or a *decimal fraction*, or *partly an integer and partly a decimal fraction*, then each digit represents *some multiple of some power of ten.*

16. SAM WELLER.—The proof of *one* case only would not be sufficient. In Mansford's 'School Euclid' (*Hughes*, 1s.), the first and second cases are proved together, although two figures are given.

17. B. R. T. WADMAN.—

18. BOY BLUE, Hull.—The line you refer to occurs in the 36th stanza of the 2nd Canto of Byron's 'Childe Harold's Pilgrimage,'

'Or e'er in new Utopias were ared,'

or ever new schemes were introduced. 'Ared' is merely *another form* of 'aired.'

19. E. A. J., Minehead.—*De Tallagio non Concedendo* was the name given to a clause added to the two great Charters, *Magna Charta* and the *Charter of the Forests*, when the Barons, headed by Roger Bigod, Earl of Norfolk, and Humphrey Bohun, Earl of Hereford, forced Edward I. to sign *Confirmatio Chartarum* in 1297. It enacted that taxes (*tallagia*) cannot be levied by the King alone, but only by the common consent of the realm expressed by Parliament.

20. L. BROWNE.—Write to Messrs. Cassell and Co. for their list, or to Messrs. W. and R. Chambers.

21. X. Y. Z.—Yes.

22. EX.-P.T.—No.

23. W. M.—

24. TROJAN.—Consult a work on the 'History of the English Constitution.'

25. MILLIE.—You must be bound for *two* years, at least.

26. BANKS, Bury.—How many horse-power is an engine with a 9-in. cylinder, 18 in. stroke, 220 strokes per minute; average pressure of steam, 35 lbs. per square inch?

(1 horse-power will raise 33,000 lbs. 1 ft. in a minute.)

Area of cylinder $= 9^2 \times {\cdot}7854$;

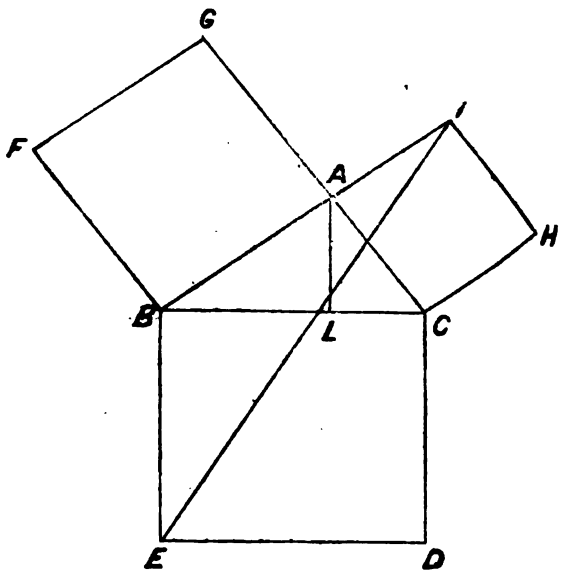
Pressure on cylinder $= (81 \times {\cdot}7854 \times 35)$ lbs.

$$\therefore \text{Horse-power} = \frac{81 \times {\cdot}7854 \times 35 \times 18 \times 220}{33000 \times 12}$$

$$= \frac{222{\cdot}6609}{10}$$

$$= 22{\cdot}26609.$$ Ans.

27. J. HESLOP, Aldoth.—On the hypotenuse and sides of the right-angled triangle ABC describe the squares BCDE, ABFG, and ACHI. The line joining D and F equals 52·5, and that joining E and I 42; and the perpendicular from the angle A upon BC divides the hypotenuse into segments in the ratio of 2 : 1. Required the area of the triangle ABC.



Let $LC = a$, then $BL = 2a$.

$$AL = \sqrt{BL \times LC} = \sqrt{2a^2} = a\sqrt{2};$$

$$AB = \sqrt{AL^2 + BL^2} = \sqrt{2a^2 + 4a^2} = a\sqrt{6};$$

$$AC = \sqrt{AL^2 + LC^2} = \sqrt{2a^2 + a^2} = a\sqrt{3};$$

$$\text{Sin ABC} = \frac{AL}{AB} = \frac{a\sqrt{2}}{a\sqrt{6}} = \frac{1}{\sqrt{3}}.$$

$$EI^2 = EB^2 + BI^2 - 2EB.\ BI \cos EBI$$

$$42^2 = BC^2 + (BA + AC)^2 - 2bC\ (BA + AC) \cos (90° + ABC)$$

$$5764 = 9a^2 + (a\sqrt{6} + a\sqrt{3})^2 - 2.\ 3a\ (a\sqrt{6} + a\sqrt{3}) \times -\sin ABC$$

$$= 9a^2 + a^2\ (9 + 2\sqrt{18}) - 6a^2\ (\sqrt{6} + \sqrt{3}) \times -\frac{1}{\sqrt{3}}$$

$$= 18a^2 + 6a^2\sqrt{2} + 6a^2\ (\sqrt{2} + 1)$$

$$= 24a^2 + 12a^2\sqrt{2}$$

$$(2 + \sqrt{2})a^2 = 147.$$

$$\therefore a^2 = \frac{147}{2 + \sqrt{2}} = \frac{147}{\sqrt{2}\ (\sqrt{2} + 1)}.$$

$$\text{Area of triangle ABC} = \tfrac{1}{2}BC \times AL$$

$$= \tfrac{1}{2} \times 3a \times a\sqrt{2}$$

$$= \frac{3a^2}{\sqrt{2}}$$

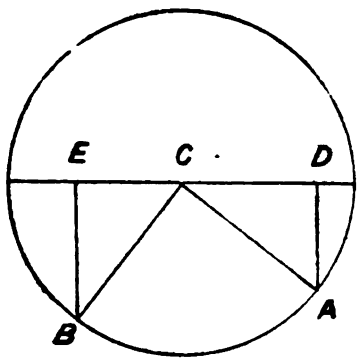
$$= \frac{3}{\sqrt{2}} \times \frac{147}{\sqrt{2}(\sqrt{2} + 1)}$$

$$= \frac{441\ (\sqrt{2} - 1)}{2\ (\sqrt{2} + 1)\ (\sqrt{2} - 1)}$$

$$= \frac{441(\sqrt{2}-1)}{2}$$
$$= \frac{441(1{\cdot}4142\ldots - 1)}{2}$$
$$= \frac{441 \times 1{\cdot}4142\ldots}{2}$$
$$= 441 \times {\cdot}7071\ldots$$
$$= 311{\cdot}87\ldots \text{ Ans.}$$

28. F. P.—You must have copied your query incorrectly. Please repeat it.

29. THE MOLE.—A circular plate, whose radius is 20 inches, is movable about its centre C in a vertical plane; from two points A and B in the circumference, 90° apart, weights of 18 and 24 lbs. respectively are suspended by cords; find the distance of the lighter weight above or below the horizontal line through C when the plate is at rest. (*Newth's* 'Smaller Natural Philosophy.')



$$24 \times CE = 18 \times CD;$$
$$4 \times BC \cos BCE = 3 \times AC \cos ACD;$$
(But BC = AC, and BCE = 90° − ACD.)
$$\therefore\ 4\cos(90° - ACD) = 3\cos ACD$$
$$4\sin ACD = 3\cos ACD$$
$$\frac{\sin ACD}{\cos ACD} = \frac{3}{4}$$
$$\frac{\sin^2 ACD}{\cos^2 ACD} = \frac{9}{16}$$
$$\frac{\sin^2 ACD}{\sin^2 ACD + \cos^2 ACD} = \frac{9}{25}$$
$$\sin^2 ACD = \frac{9}{25}$$
$$\therefore \sin ACD = \frac{3}{5};$$
$$\text{But } \sin ACD = \frac{AD}{AC} = \frac{AD}{20};$$
$$\therefore AD = \tfrac{3}{5} \text{ of } 20$$
$$= 12 \text{ in. Ans.}$$

30. W. MUSCOTT.—By sailing round the globe in a general easterly course the sun will rise earlier each successive morning, as shown by a watch keeping Greenwich time. At the 180th meridian, or half-way, the difference will have gradually amounted to twelve hours. Thus far eastwards, however, the same name of the day of the week is retained, though these began twelve hours earlier than at Greenwich; but, beyond the 180th meridian when the second twelve hours' gain is entered upon, the *whole day* is considered to have lapsed, and Friday succeeds Wednesday. 'Thursday had no existence *for* US.' See Langler's Mathematical Geography. In a voyage westwards a day would for corresponding reasons have to be added.

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Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers whose name and address we will gladly give.

Magnetism and Electricity. By R. Wormell, D.Sc., M.A. Thomas Murby, 32, Bouverie Street, Fleet Street, E.C.

FIRST NOTICE.

If all the High School Series, of which the volume under review is one, are as excellent as Dr. Wormell's little treatise, their standard will be very high. We have had, if we may be permitted to say so, too little of Dr. Wormell of late. The demands upon the time of the head-master of a large school are great, and save to those who have made acquaintance with his book on 'Dynamics,' the head of the City of London Middle-class Schools is only known as an author by his 'Natural Philosophy.' This book bears traces of having been written up to certain plates, as Mr. Vincent Crummles required Nicholas Nickleby to write a play up to the practicable pump of which he was the happy possessor, and further shows but little indication of the remarkable clearness in explanation that distinguishes both the 'Dynamics' and the book now under consideration.

Beginning, most wisely, with magnetism, Dr. Wormell treats the subject in ten lectures. These deal respectively with the following subjects:—I. Introduction, in which the properties, polarity, methods of preparation of magnets are considered. II. Magnetic Properties. III. Induction. IV. Curves of Force. V. Electro-magnetism. VI. Terrestrial Magnetism. VII. Strength of Magnets. VIII. Ship's Magnetism. IX. Diamagnetism. X. Molecular Changes. After the ten lectures follow a number of instructions as to simple experiments other than those already dealt with in the course of the lectures, and quite within the range of any boy of ordinary acuteness possessing the normal number of fingers, a few definitions, and magnetic odds and ends that would, we venture to think, have been better incorporated in the main body of the book. Twelve lectures on Electricity follow. These he heads Introduction, Induction, Condensers, Capacity and Potential, Voltaic Cell, Galvanometers, Chemical Effects of the Currents, Resistances, Magneto-electric Induction, Electricity and Heat, Electric Telegraph, Recent Inventions. At the end of each lecture, a number of simple pieces of electrical apparatus are described as to their construction, as to their use, with the exception of lectures 4 and 10. The experiments and practical work having relation to lecture 5 are given in connection with those belonging to lecture 6. Some advanced experimental work follows, then, rather strangely, the index, and the volume closes, save for advertisements, with a series of examination questions on the two subjects whence it derives its title.

We have analysed the contents of this book at some length, because the book is so excellent. For the same reason, we now point out what seem to us to be blemishes therein. (1) On p. 7, the derivation of 'loadstone' is open to question. Higher philological authorities than we can lay claim to be ascribe its name, not to its property of leading the mariner, but to its property of leading or drawing towards it iron bodies. So that in old times a knight clad in armour was in danger, if he approached a loadstone rock, of being drawn bodily, armour and all, towards it and held there, no matter what were his engagements. (2) On p. 8 Dr. Wormell adopts that which seems to us the best nomenclature for the two ends of a magnet—viz., the marked or north-seeking, and the unmarked or south-seeking end. But on p. 9 he begins to talk of 'north end' and 'south end,' and thus his re-

markable book, like all the others, must confuse the unhappy student. And confusion grows worse confounded when, on p. 57, we find the 'blue end' of the magnet appearing in ghostly and inexplicable fashion. (3) P. 10. It is not rendered clear to the student why, in the experiment described, the floating corks, needle-pierced, move towards the side when the 'south end' of the magnet (whatever that may be) is presented to them, whilst, when the 'north end' of the magnet (whatever that may be) is brought near them they all move towards the centre. (4) On p. 11 the far more common name of 'consequent poles' might with advantage be given, as well as the rarer 'intermediate poles.' (5) On p. 21 Dr. Wormell discusses magnetic induction, and, we think, will succeed in confusing the mind of any boy who reads his book. Dr. Wormell, following that which we conceive to be the evil example of certain other able writers, uses the word 'Induction' in a different sense in magnetism from that wherein he employs it in electricity. Thus, on p. 84, he gives the true definition of induction when he says that it is a 'method of producing electricity in a body' by 'the simple presence of an electrified body.' It is a method of causing redistribution of electricity in a body without actual contact between that body and the electrified one causing the change. Yet, in his experiments to illustrate *magnetic* induction, Dr. Wormell has pieces of soft iron touching the pole of the magnet. 'It will be attracted, supported, and converted into a magnet [surely the last should be first and the first last here] by induction,' writes Dr. Wormell. But surely the value of words ceases to be, altogether, if they are to be used thus loosely. Induction in magnetism is due to contact. Induction in electricity is due to action at a distance! (6) P. 25. The distinction between a keeper and an armature is not brought out. Indeed, they are represented as synonymous terms. An armature, however, is a piece of soft iron attached to *one* pole of a magnet. A keeper is a piece of soft iron connecting the *two* poles of a magnet. (7) Very rarely can we accuse Dr. Wormell of inaccuracy or looseness of phraseology. But on p. 38 we read, '*Lines of equal declination* are sometimes called isogonic lines.' 'Lines joining places where the angles of declination are equal, etc.,' would read rightly. The last sentence on p. 38 that runs on to p. 40 (p. 39 contains a map), besides being quite Clarendonian as to its pronouns, is absolutely without meaning owing to the omission of a word. P. 64, line 9, we have the statement that the 'median line' of a magnet 'approaches nearer the opposite end' to that which is heated. How can a median line shift? (8) P. 63. The expression, 'coercive force' is used. Nowhere in the book is it explained that this phrase means the power with which a magnet retains its magnetism. (9) P. 99. The free electricity, line 4 from the end, would surely be positive, not negative. (10) P. 114, line 5. Dr. Wormell does not say with which quadrants of the Thomson's electrometer the bodies to be tested are connected; a vital omission. (11) P. 120. A list is given of the proofs that a current is passing through a wire. Immediately afterwards these effects are studied in exactly the reverse order. Then the list ought to have been made out in the reverse order. (12) P. 133 (note). No explanation is given of the angle a. There is no intimation as to what angle it is. (13) P. 141. Surely Dr. Wormell knows that potash is not a binary compound "of the metal potassium and oxygen." It is a ternary compound of potassium, hydrogen, oxygen, of symbol KHO. (14) 157. Is it not a pity in a high-class book like this to even so much as refer to the Fahrenheit scale? The more rapidly that unhappy scale is relegated to the limbo of futilities the better. (15) P. 159. It might be as well for beginners to show that ·0009 (line 6) is the square of the ·03 of line 3. (16) The terms inverse and direct current (p. 175) are used without a solitary word of explanation. (17) The commutator is referred to in lecture 9. No description of it occurs until after lecture 9 amongst the 'apparatus to be made.' (18) P. 191. It is very questionable whether young students will quite grasp the mathematical reasoning, simple as it is, at the end of this page. The steps might with advantage be simplified. (19). Finally, as conclusion of this disagreeable, thankless, and easy task of fault-finding, Dr. Wormell's numbers, *re* magnetism, differ greatly from Professor Guthrie's. How is the poor student to decide when doctors and professors disagree?

Rapid Computation: a New Course of Mental Arithmetic. By J. Baines and J. J. Prince. London: Murby.

These little manuals are adapted to the three first Standards of the New Code, and form a systematic and practical introduction to arithmetical science. It is often forgotten how very much arithmetical operations depend upon mental processes, and hence the pursuit of Mental Arithmetic has been often disconnected with ordinary arithmetical operations, and associated with such apt combinations as dozens with shillings and pence, and scores and tons, with pounds and shillings. Without undervaluing the latter processes, which almost every tradesman carries on with such astonishing celerity in his special business, as to leave the obfuscated purchaser merely able to make off with his change as meekly as possible, we need scarcely remark that the foundation for all expertness in computation is good systematic drilling in the elementary stages, and upwards. Nothing is lost in this being extensively carried out in the simple rules of Addition and Subtraction. But such exercises, unless in the hands of skilful teachers, are apt to become dry and unattractive. The use of Mr. Baines' lessons removes this objection by lively concrete examples in which interest is stimulated by the very mention of the common objects of daily life. 'What will 10 oranges cost at 2 a penny?' is much better than asking 'How much is ten times two pence?' The little books before us begin with *Exercises*, with directions for their judicious use, and are followed by *Recapitulatory Exercises*, containing a capital variety of examples sure to excite and sustain attention.

Cambridge Examiner and Oxford Examiner. London: E. Stanford.

We have received several numbers of these monthlies. They contain model examination papers, designed, not only to lighten the work of the teacher, but to secure the success of the candidate. The venture is worthy of support, and has our best wishes.

The Student's Algebra. By James Mackean, F.E.I.S. Royal School Series. T. Nelson and Sons.

Like most of the works brought out by this firm, the printing and paper are excellent, the type used being very clear and readable, and the book being, as far as we could discover in a pretty thorough 'overhaul,' very free from errata and slips of any kind.

Mr. James Mackean has in this work struck out a method of dealing with his subject differing in some important respects from that adopted in most text-books on the same theme.

Instead of encumbering the path of the beginner with a small army of definitions, many of which he will not need at these early stages, and which only tend to discourage him, the author has, to use the words of his preface, 'deferred giving definitions till they are about to be used, and introduced Equations and Problems at the earliest possible stage, in order to interest beginners.'

This plan is worked out in a very complete manner, and although we might take exception to the elaborate explanation given to facts which are common to both Arithmetic and Algebra, and which a student in Algebra might very well be assumed to understand from his *prior* acquaintance with Arithmetic, this is an error (if error it may be called) on the right side, and will tend to make the book

more serviceable than usual to those learners who are obliged by circumstances to do without a teacher and to depend on 'private study.'

Another noticeable feature, which will also prove a boon to the private student, is the large number of illustrative examples clearly and thoroughly worked-out before entering any fresh rule.

The scope of the work, which is divided into two parts —Part I., Elementary, and Part II., more advanced—is such as to make it useful for preparation for most Examinations. The last five chapters of Part II. are on the Progressions, Indeterminate Equations, Permutations, etc., Binomial Theorem, Logarithms, and Interest.

We give the work our hearty approval.

Science Ladders, Forms of Land and Water. By N. D'Anvers. London: S. Low, Marston and Co.

This introduction to Physical Geography forms the first of a series of SCIENCE LADDERS in the shape of reading lessons. The author's plan in the book before us is explanatory rather than inductive, and appeals less to home observation as the foundation for geographical knowledge than many modern writers of school books regard as advisable. The book, however, is not confined to the explanation of geographical terms and phenomena, which constitutes its chief feature. It occasionally branches off to theories which are far from being generally accepted. 'The water of the ocean is made salt by a substance melted out of rocks by rivers, and brought by them to the sea,' is an awkward explanation of a disputed theory. If young readers are to have such matters brought before them, it will be better to tell them that the causes of such things are either not known or disputed. The author's partiality for fanciful, and, in several cases, questionable English leads him into such amusing sentences as the following: 'Water always seeks other water, and very soon two little springs meet, and make what is called a stream.' Water may seek as much as it pleases, but will have little chance of mingling with other water unless brought in contact with it. Make an opening below, and away runs the water, faithlessly deserting companion fluid, to get to *the lowest place.* 'Are the two springs content when they have met and joined their waters?' We should hazard a 'No!' on account of the rumpus they kick up in meeting. But the author's 'No' gives us quite a different explanation of this discontent. 'No,' he says; 'the stream in its turn seeks another stream, and when two streams meet they form a river.' Wonderful, this! But we go on:—'This meeting of streams generally happens in the uplands of the world [where can that be?], which are called the *Gathering-places of the waters.*' We have looked in vain in Malte, Brun, and other leading authorities, for this locality. The gushing forth of water into springs is attributed by the author to 'this water always trying to get into the air and light.' Very good taste this, on part of water, but unfortunately not always carried out by this unstable element, for if a subterranean channel be dug the water will be equally disposed to run down into it, and desert its beloved air and light. All this may be amusing, but it is sorry science. We are treated to a new theory of the tides in the following brief explanation of this subject, which we, in our ignorance, thought was somehow connected with the differences of attraction exerted by the moon on different sides of the earth, and simply owing to the earth's diameter forming an important element (one-thirtieth) of the moon's distance. But our author polishes off the whole Theory of the Tides thus succinctly:—'It is the attraction of the moon which causes the tides, for it [the moon] has the power of drawing the waters towards itself.' Now we ask in all sober seriousness whether the evident meaning of this passage is not to attribute to the moon a singular if not exceptional power of attraction for water? Better, ten times better, that phenomena should remain unexplained, than young students be deluded into accepting such vague statements as explanatory. After this we are ready to agree with the author, that 'the facts we have learned to-day have been ew, but very wonderful.' Very!

Outlines of Hebrew Syntax. By Dr. A. Müller, Professor in the University of Halle. Translated and edited by James Robertson, M.A., D.D., Professor in the University of Glasgow. Glasgow: Maclehose and Sons.

The Hebrew Grammar prepared and published by Professor Müller, of Halle, has met with deserved success in Germany, owing to its lucid arrangement, its use of the latest and best results at which the great Hebraists of that land have arrived, and the independent employment of all the materials on which such a work must be constructed. The author states his reasons for the appearance of a new Hebrew Grammar, notwithstanding Kautzsch's edition of Gesenius's well-known work, putting the merits of the latter somewhat lower than they should be. He claims for his Syntax that it is more scientific than that of Gesenius's, while it is more practical than that of Ewald's copious Lehrbuch.

The book before us is a translation of the third part of Müller's School-grammar, that which contains the Syntax, and to which the author attaches most value. The translation is an excellent one, the work of a man who understands the Hebrew language, and is competent to make suggestions worthy of adoption. Dr. Robertson has not only translated, but *edited* the original under the superintendence of the author; the portion selected having received various additions and improvements from both, so that it may be justly considered a new edition of the *Hebräische Schulgrammatik*, Part III.

We are far from thinking that the Syntax of any existing Hebrew Grammar, not excepting that of Ewald's, which has influenced all attempts to put that part on a scientific basis, is entirely satisfactory. Improvement is needed still; especially as regards the tenses and moods. Even *vau conversive* is not yet cleared up. The learner is apt to be bewildered amid a number of details, some of which are scarcely distinguishable from others. He desiderates comprehensive groupings, and does not find it. Greater simplicity should be aimed at, especially in a grammar for schools. The influence of Ewald has led his followers into a multitude of details which may be of practical use, but are not sufficiently scientific.

Professor Müller is evidently a painstaking and cautious scholar. He is even disinclined to give his opinion about the propriety of a suffix being inserted between the construct state and its genitive, saying only that many expositors maintain its *possibility*. The two examples he adduces show more than that, and the second is not well regarded by him as an adverbial accusative. Indeed, the section headed 'Adverbial Accusative' is not a favourable example of the author's acuteness.

We commend the volume to the attention of all students who wish to master the chief peculiarities of Hebrew Syntax. It should be compared with Kautzsch's Gesenius, which it can hardly supersede, though superior in various statements and in the presentation of appropriate examples.

Standard Grammar. Book IV. By J. M. D. Meiklejohn. London and Edinburgh. Chambers.

This book is devoted to the Analysis of Sentences. The exercises preceded by full explanations are carried systematically from the most simple to most forms of complex sentences. We need scarcely remark that much knowledge of the nature of words, usually comprised under the terms etymology and syntax, is given in Mr. Meiklejohn's lucid remarks. The whole arrangement is most satisfactory, and free from the pedantic innovations that mark many text-books of Composition and Analysis. The three last pages are filled with a capital list of prefixes and suffixes of the ordinary sources of Anglicised words.

Chambers's Etymological Dictionary of the English Language. Revised Edition. London: W. and R. Chambers.

There are some tools with which the literary workman and student cannot dispense, and one of the most important of these is an English dictionary.

We have used the book before us for thirteen years, and can heartily recommend it as being clear, trustworthy, well-arranged, and cheap. The 'Select List of Mythological and Classical Names,' and 'The Metric System,' form valuable features of this revised edition.

Lays of Ancient Rome. By Lord Macaulay. London: Longmans, Green and Co.

It would be a waste of our own and our reader's time to criticise Macaulay's 'Lays.' We therefore simply draw attention to these cheap, clearly printed, and in the case of the cloth edition, strongly bound reprints. Messrs. Longmans have done a public service in sending forth to the world the great historian's noble 'Lays of Ancient Rome' at so moderate a price.

Jarrold's Empire Readers. By S. B. Tait. London: Jarrold and Sons.,

These reading books have been prepared with exceptional care. They are carefully graduated, and admirably suited for standard work. The selection of poetry is excellent. The binding is strong, but some of the illustrations are certainly unworthy of the series.

Our Little Ones. March, 1882. London: Griffith and Farran.

This is a gem of a magazine for the young. The illustrations are superb.

Poetry for the Young. London: Griffith and Farran.

Of one of the parts of this large volume it was our pleasure, some time ago, to speak highly. It is with even greater pleasure that we notice the complete work.

Admirable taste and judgment have been shown in making the selection, which contains many new (to English readers at least) and old gems.

'Poetry for the Young' is a carefully graduated, comprehensive, poetical reading book, handsomely bound, and remarkably cheap.

English History Home Lesson Books. Part IV., for Standards V. and VI. National Society.

This forms one of a series intended to be used with the text-book in English History by Miss Yonge, and comprises the heads of leading events of each king's reign. These heads are intended to be suggestive helps to the writing out of Home Evening Lessons, and not to be a cramming substitute for more detailed information. Writing exercises are appended in the historical biographical topics mentioned, together with exercises in map-drawing and royal geneulogies. Appended to each short chapter is a poetical extract to be committed to memory, the selection of which evinces excellent taste and judgment. The fragile paper cover is surely a drawback to anything in the way of a Home Lesson Book. For this we would recommend cast iron if it were flexible, or the nearest approach to this that leather or canvas can furnish.

[Through great pressure on our space several Reviews in type are held over.]

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Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

III.

WOUNDS—(*continued*).

IT will be all but useless to strap up or bandage a wound in which an artery has been divided; any attempt therefore to do without skilled surgical assistance would be attended with serious danger to the life of the boy. The surgeon as soon as he has made out the position of the wounded artery will enlarge the wound and place a ligature on it above and below the part injured. If it be a small artery, a ligature of the upper portion and so-called torsion of the lower may be sufficient. The lips of the wound will be brought together and treated just the same as if no ligature had been used. The cut surface may be anointed with carbolised oil, and some antiseptic lint or gauze applied and kept in its place by a bandage. It will be found that if this has been skilfully applied that there is no suppuration, so-called, that is that there is no pus or matter formed, and the wound heals by first intention (another surgical term which in effect means without suppuration), the child is well in a few days, provided the injured part is kept at rest and not allowed to be damaged in any other manner. The ligature comes away in a few days, and is no detriment to the healing process. Clean incised wounds in which there has not been any injury to an artery are easily dealt with and soon get well. If they are dirty they must be well cleansed with pure water, so that all foreign bodies (that is, all extraneous matter) may be entirely removed, then apply carbolised oil freely, bring the lips of the wound together by narrow strips of adhesive plaster, and cover up with antiseptic gauze.

Lacerated Wounds.—These never heal by first intention; the torn parts contain damaged tissue, which is sure to die, and must be removed from the injured part before the flesh will heal and the skin cicatrize; but if the laceration is not severe it may be treated as directed for contused wounds. Laceration of the fingers and toes, such as are produced by rusty nails and jagged iron on park palings and similar fences, are sometimes followed by very serious results, though the wounds themselves may not appear at first to be of much moment. Skilled assistance should be sought for in any such case, and in the meantime it is best to bathe with warm water for a short period, and then cover up from the air. It used to be a custom to push pledgets of lint into such wounds to keep them open; all these kinds of insertions are injurious: indeed, it is never right to put foreign bodies, except ligatures, in fresh wounds under any kind of pretence; bring the parts into as natural a condition as can be done, and keep them so by gentle means; all tight bandages and all closely fitting compresses are wrong; antiseptic gauze gently applied may allow of a great part of the mischief being repaired without the production of any constitutional disturbance. By the term constitutional disturbance is meant the reaction which is set up in the system after the shock of a wound of any kind. A moderate amount of local inflammation is necessary to heal a wound in every case, but if it goes beyond the locality then the action is said to be constitutional; and if increase of heat results—which is a kind of fever—it shows that the mischief has gone beyond the line necessary for the healing process to be completed. This constitutional disturbance may run high in those suffering from the effects of lacerated wounds, especially if they are so-called inflammatory subjects—that is, if they have been accustomed to take much animal food and drink alcoholic liquors. The total abstainer, if he is also temperate in the use of flesh meat, is seldom, if ever, inflammatory, and his wounds heal by the first intention in a most convenient and comfortable manner.

Sometimes a finger is torn off completely, and an enquiry is made as to the possibility of obtaining a reunion of the severed parts. Reunion in such a case is not possible; but if there is any part remaining attached it should not be separated until the surgeon has determined whether it can be saved or not. A small attachment will be sufficient to keep up vitality in the case of a clean incised wound; but if the part is lacerated the retention of vitality in the separated part is not likely to ensue. The constitutional disturbance which a lacerated wound sets up is to be met by simple diet and warm application to the wounded part. The application of warm water to the part affected by means of lint under oil silk is the most comforting. This should be frequently changed, and

occasionally as inflammation comes on it should be applied cold, to test the comfort. It will be found that sometimes warmth is most soothing, at others the application of cold water is most grateful to the patient, and in all these cases the feelings of the patient may be consulted, and that application used which he finds most soothing and most grateful to his feelings. Some cooling aperient should be given if the bowels are confined and the appetite indifferent; this may consist of a little citrate of magnesia or a teaspoonful of some other aperient saline in warm water. If suppuration arises—that is, if pus or matter forms in the wound—a poultice of bread and water or of linseed meal may be applied with advantage, but these must be made in a proper manner and not in the way in which I occasionally see them done, even in clever people's houses. Skill is required in making a poultice, as well as in every other simple work. The best method of making poultices will be described when discussing the treatment of abscesses. The position of a wounded part should always be such as is most comfortable to the patient. It is a serious error to place it so as to be irksome. Ease should be studied, provided that ease is natural. If it is only found in an unnatural position it is wrong and must be fought against, and in the course of time the unnatural position will be overcome and ease found in a more satisfactory state. When ease is obtained in a position which is unnatural there is mischief going on somehow which must be obviated. Lacerated wounds are sometimes followed by lockjaw or tetanus, as it is surgically called. It is an affection of the spinal cord, which is produced by reflex action proceeding from the nerve which has been lacerated, reacting upon the spinal nervous system. There is a stiffness about the jaws and neck, which is slight at first but slowly increasing in intensity, and ultimately the muscles which move the jaws are no longer able to act; they become fixed and rigid, so that the jaws can neither be opened nor closed, and tetanus is established. It is generally fatal. There is a form of tetanus which arises from other causes, such as poisoning by strychnine, but this latter differs from traumatic tetanus, or that which is due to a wound. In the one case the invasion is sudden, in the other it comes on gradually and of course after a punctured or contused wound has been known to have been received. In lockjaw connected with wounds the mischief is restricted at first to the stiffness in the jaws, but in poisoning by strychnine it almost immediately invades other muscles in the neck and back. It is requisite to keep this distinction in mind, and not let strychnine poisoning be mistaken for lockjaw. Lacerated wounds seldom bleed much, unless an artery has been torn. They are sometimes followed by erysipelas, the course to be followed in such cases will be mentioned when treating of the latter disease.

Punctured Wounds are often more serious even than lacerated wounds, especially when made with a narrow pointed instrument, such as a rusty nail. The thrust of a penknife or one blade of a pair of scissors may go a considerable depth, whilst the external wound may be quite small. In a stab the danger always depends upon the injury which the fibres have suffered from laceration as well as from the cutting surface of the instrument. The puncture may have passed through an artery, or a vein without dividing it, and the surgeons aid must be quickly obtained; in the meantime, it is prudent to keep the wounded part at rest as much as possible and if any application is used let it be carbolised oil poured into the wounded part and the air kept from it, whilst if there is hæmorrhage it may be restrained by gentle pressure upon the wounded part until the surgeon arrives. Suppuration will take place in these cases, and that as well as the constitutional disturbance is to be met as is suggested in the case of a lacerated wound, and we must guard against the violent inflammation which often supervenes.

Poisoned Wounds are of several kinds, such as those produced by the stings of bees, wasps, and hornets, and the bites of vipers and other snakes; the absorption of poison from metallic applications and those which follow upon the absorption of animal poisons, such as comes from the decomposing flesh of animals, and the so-called dissection wounds, which boys will get sometimes from their curiosity in investigating the nature of decomposing animal remains; and, lastly, dog and cat bites, which are very uncomfortable, and frequently most painful. The stings of bees, wasps, hornets, and other insects are best met by applying at once to the injured part some alkali or alkaline earth, which shall neutralise the acid of the sting. The old woman's application of the blue bag is founded upon good chemical action, for the chalk in the blue neutralizes the acid at once, if it be applied immediately. A little sal-volatile in water, one part in three, may be useful if put on immediately, but it is not of any use to apply ammonia in any form, unless at or immediately after the moment at which the bite is inflicted. If any inflammation has come on, the application of sal-volatile or the ammonia salt will increase it, doing harm instead of good, and possibly setting up erysipelas or some other inflammatory action. Every wasp or bee destroys itself by leaving the sting in the flesh of the injured part. This must be extracted by means of a fine pair of tweezers or forceps. The resulting inflammation may be kept down by the application of a cold lotion, or dusting it over with violet powder or simple chalk, and avoiding irritating applications of all kinds, and also keeping it from the effects of the sun-light, if it be a hot day.

Snake Bites in this country are limited to that of the adder. These bites are not usually fatal, unless the blood of the bitten person is in a very unhealthy state from excessive use of stimulants or too much animal food. There is generally faintness immediately after the bite has taken place. This faint condition should be counteracted by some sal-volatile or other diffusible stimulant, and the bitten part treated just as described for a wasp sting. The inflammation and swelling are sometimes very great, and there will be a strong desire on the part of the surgeon to use the knife, and to make free incisions to relieve the tension. I am satisfied from experience that this is wrong treatment, and that every effort should be made to prevent the chance of suppuration, which incision increases. There will be no formation of pus, except under the most exceptional circumstances, and there will be no ultimate danger if suppuration does not arise. Keep the swollen part warm, and avoid pressure. It will be found to subside in a day or two without leaving any mischief behind it. Nitrate of silver is sometimes applied to stay the resulting erythema. This is bad practice.

Wounds which have been poisoned by decomposing animal matter belong to a different category. These are followed by inflammation of the veins and absor-

bents of the part, and quickly extend to the whole of the system. Pyæmia results. In the case of an adder-bite the mischief is restricted to the cellular tissue of the limb affected, and the action of snake-bite is probably chemical. The resulting inflammation does not reproduce its like, but in the dissection wound there is a manufacture of material in the body of a similar kind. The morbid matter is reproduced in quantity, and is capable of reproducing similar mischief in other people. The pain follows the course of the veins and absorbents. There is much constitutional disturbance, and the assistance of the surgeon must be obtained as soon as possible.

(To be continued.)

Eminent Practical Teachers.

PESTALOZZI.

BY THE REV. CANON WARBURTON, M.A.,
Her Majesty's Inspector of Training Colleges for Schoolmistresses.

III.

WE next hear of Pestalozzi at Burgdorf, first in the somewhat unexpected position of assistant to the mistress of the infant department of the 'primary schools' in that town; and a year later, with three partners, in charge of what we should call a 'proprietary school.'

This was in the winter of 1800, and in the following year Pestalozzi published his third celebrated book, entitled 'How Gertrude Teaches her Children.' The title of the book is misleading, for it contains little or nothing specially adapted for the guidance of mothers, and plunges at once into the polemics and the philosophy of education. Nor is the only inconsistency to be found in the title-page. More will be told about this in the next number, in which some account will be given of Pestalozzi's system; but it has been truly said of the volume in question, that 'it contains educational principles of the highest value and importance, side by side with the most glaring blunders and inconsistencies, and has to be constantly corrected by the common sense of the reader.'

But to return to Pestalozzi's work as a schoolmaster at Burgdorf. John Ramsauer, who at the age of ten became one of his pupils there, has given a vivid account of his experiences in the institution, from which the following extracts are taken.

'I got about as much regular schooling as the others, namely, none at all, but our master's sacred zeal, his devoted love which made him entirely unmindful of himself, his depressed and anxious state of mind which even struck us children, made the deepest impression on me, and knit my childlike and grateful heart to him for ever.

'The instruction which we received was limited to drawing, cyphering, and exercises in language. We neither read, nor wrote, nor committed to memory Take as a specimen of an "Exercise in language, drawn from natural history:"—he would say, and we had to repeat the words after him, while our eyes were fixed on our drawing, "amphibious animals—crawling amphibious animals—creeping amphibious animals—monkeys, long-tailed monkeys, short-tailed monkeys," and so on. We did not understand a word of this, for not a word was explained, and it was all spoken in such a sing-song tone and so rapidly and indistinctly that it would have been surprising if any one had understood anything of it: besides, Pestalozzi cried out so dreadfully loud, and so incessantly, that he could not hear us repeat after him; our repetition consisted mainly in saying the last word or syllable of each phrase, thus "monkeys—monkeys, or 'keys, 'keys." There was never any questioning, or any recapitulation.

'As Pestalozzi in his zeal did not tie himself to any particular time, we generally went on till eleven o'clock with whatever he had commenced at eight, and by ten o'clock he was always tired and hoarse. We knew when it was eleven by the noise of other school-children in the street, and then we all ran off without bidding him good-bye.

'The first time that I was taken into Pestalozzi's school he cordially welcomed and kissed me. He then quickly assigned me a place, and the whole morning did not speak another word to me, but kept on reading out sentences without pausing for a moment. As I did not understand a bit of what was going on, when I heard the word "monkey," "monkey," come every time at the end of a sentence, and as Pestalozzi, who was very ugly, ran about the room as if he was wild, without a coat, and without a neckloth, his long shirt-sleeves hanging down over his hands, which swung negligently about, I was seized with real terror, and might soon have believed that he himself was a monkey. During the first few days, too, I was all the more afraid of him, because he had, on my arrival, given me a kiss with his strong prickly beard, the first kiss which I remember having received in my life.'

We may be inclined to smile at this only too graphic picture of the oddities of Pestalozzi, but it is given with perfect simplicity by Ramsauer, whose heart had been completely won by the kindness, and whose respect by the nobility of character of the great teacher. Meanwhile the fame of the institution grew rapidly; numbers of visitors came from all parts of Switzerland to witness the practical working out of the principles enunciated in 'How Gertrude Teaches her Children,' and at the end of three years the school's utility and success were so generally acknowledged that, though conducted as a private adventure, it began to receive small grants from the public funds. But once more Pestalozzi's evil star prevailed; the Directional Government of Switzerland was dissolved by Napoleon and the old constitution of the Cantons restored. The new Bernese administration fixed on Burgdorf Castle for local head-quarters, and the school had to clear out of it on the 22nd of August, 1804. Pestalozzi attended as one of a deputation to Paris elected to represent to 'the First Consul' the 'wants of Helvetia,' but his educational projects altogether failed to attract the interest of Napoleon, who flatly told the discomfitted enthusiast that 'he was not going to mix himself up with the teaching of the A B C.' Another member of the mission was the celebrated educationist Fellenberg, who four years before had founded his well-known school at Hofwyl. When the Bernese authorities turned Pestalozzi out of Burgdorf Castle, they gave up to him the monastery of Buchsee, adjoining which was Fellenberg's estate of Hofwyl, and to him, 'Not indeed without my consent,' says Pestalozzi, 'but to my intense mortification was handed over the general direction of my school.'

Fellenberg possessed in an eminent degree what Pestalozzi so grievously lacked—namely, practical administrative ability. But when, in 1840, this school at Hofwyl was visited by Sir James Kay-Shuttleworth—an honoured name in the history of English Education—Fellenberg admitted that he owed everything to Pestalozzi. In the former the intellect prevailed, in the latter the feelings: under Fellenberg better order was maintained, but love was missing. His hand was found to be too heavy, and Pestalozzi, receiving an urgent invitation from the inhabitants of Yverdun in the Canton of Vaud, migrated thither in 1805 with his school and staff, 'for the teachers,' he tells us, 'found the government of Fellenberg far more distasteful than the want of government under me.'

Pestalozzi was now, at the age of fifty-nine, at the height of his reputation. Yverdun soon came to be recognized as a European training school for teachers. 'Pestalozzian schools' were established at Naples, Madrid, and St. Petersburg. In our own island the well-known educational reformers Bell and Lancaster had adopted many features of his system, and many philosophic writers saw in Pestalozzi and his labours 'the commencement of the renovation of humanity.'

But with all this, the migration to Yverdun marks the commencement of the period of Pestalozzi's greatest unhappiness. 'The institution,' he tells us, 'bore within itself the seeds of its own internal decay in the unequal and contradictory character of the abilities, opinions, inclinations, and claims of its members.' But for the present all seemed bright. One hundred and thirty-seven pupils, of ages varying from six to seventeen, lived in the institution, and twenty-eight lodged in the town, making 165 pupils in all. Among them there were seventy-eight Swiss, the rest were Germans, French, Russians, Italians, Spaniards, and Americans. Fifteen teachers resided in the buildings, nine of whom were Swiss and had been educated under Pestalozzi's eye. A visitor to Yverdun thus describes the externals of the institution:—

'The situation of the old castle, with its four great towers enclosing a courtyard, is extremely beautiful. A vast meadow lies between it and the glorious Lake of Neufchatel, on the west side of which rises the Jura Range covered with vineyards. We met a multitude of boys, who conducted us to Pestalozzi. His dress was the extreme of untidiness. He had on a threadbare old gray overcoat, no waistcoat, and a pair of breeches, and his stockings hanging down over his slippers, his coarse, bushy, black hair unkempt and frightful. His forehead was deeply wrinkled, his dark brown eyes now soft and tender, now full of fire. You hardly noticed that the old man so kindly and genial, was ugly; you read in his singular features long-continued suffering and great hopes.' Its internal condition is thus described by Pestalozzi himself, but it is to be feared—and indeed he subsequently admitted the fact himself—that he saw things through rose-coloured spectacles, and as he would have wished to have them rather than as they were. 'A pure paternal and fraternal feeling everywhere shines forth. The children feel themselves free, and their activity finds a powerful charm in their employments. The life in the house is to a rare extent a school for cultivating domestic affection and domestic unity. The disposition of the great body of our inmates is good: a spirit of strength, of repose, and of endeavour rests on the whole. Some pupils evince an angelic disposition, full of love, and of a presentiment of higher thoughts and of a higher existence. The bad ones do not feel themselves comfortable in the midst of our life and labour; on the other hand, every spark of good and noble feeling which still glimmers even in the bad ones is encouraged and developed. The children are neither hardened by punishment nor made vain and superficial by rewards. Their feelings are not lightly wounded; the weak are not made to compare themselves with the strong, but with themselves. We never ask a pupil if he can do what another can, we only ask him if he can do a thing, but we always ask him if he can do it perfectly. We live altogether united in brotherly love, free and cheerful, and are, in respect of that which we acknowledge as the one thing needful, one heart and one soul.' It may be well to set side by side with this report (in which is to be feared that the indicative is sometimes used instead of the optative mood) some passages from the dispassionate report of the five commissioners sent down by the Swiss Diet at Freiburg to examine the school. 'This institution in no way aims at coming into perfect connection with our establishments for public instruction. Determined at any price to interest all the faculties of children in order to direct their development according to its own principles, it has taken counsel of its own views only, and betrays an irresistible desire to open for itself new paths, even at the cost of never treading in those which usage has now established. This was perhaps the best way for arriving at useful discoveries, but it is also a design which renders harmony impossible. The institution pursues its own way, the public schools pursue theirs, and there is no probability that both ways will soon meet. It is to be regretted that the "force of circumstances" has always driven M. Pestalozzi beyond the career which his pure zeal and fervent charity had marked out for him. Let us profit by the excellent ideas which lie at the foundation of the whole undertaking, but let us also lament that an adverse fate must hang over a man who by "the force of circumstances" is constantly hindered from doing what he would wish to do.'

The publication of this report was followed by a long and embittered paper war, which brought great discredit on the institution by throwing light upon its weakest points. There can be little doubt that the extraordinary prosperity and reputation of the school had turned the heads of the teachers, producing, as Pestalozzi himself admits, 'an audacity of behaviour towards the whole world and towards everything done in education that was not cast in our own mould.' Again, with such a medley of children collected from all parts of Europe, the institution had no mother tongue. Prayers were read every morning first in German and then in French. At the lessons in the German language, intended for German children, there were French children to whom every word spoken was unintelligible. Again, despite Pestalozzi's self-deceiving optimism, the life was as unlike home-life as it well could be, and the little boys especially had to endure much hard treatment and privation. But all these drawbacks sink into insignificance when compared with the bitter dissensions which existed between the subordinate teachers. The two most prominent members of the staff were Schmid and Niederer. Of the former, a Tyrolese shepherd-boy, who had joined him at Burgdorf, 'more rude and unkempt than his master, but with the eyes and beak of a

hawk,' Pestalozzi thus writes, 'By his practical talent and indomitable activity he soared above the influence of every other person in the establishment. I looked upon the *strength* of this pupil, though still so young, as the mainstay of the house,' and later, 'Schmid threw a hard shell round the kernel of my vanishing labours and saved me.' These characteristics made Schmid an invaluable element in an institution conducted by a man 'gifted,' as Pestalozzi says of himself, 'with an unrivalled incapacity to govern,' for Niederer also, the second in command, was completely destitute, as he often acknowledged, of practical ability. He was, however, a youth of high culture and lofty intellectual ambition, and seeing in Pestalozzi, as we are told, 'a man who had grasped with instinctive profundity the subject of human culture, but had given only a fragmentary view of it, and who could not control the ideas which, as it were, possessed him,—he believed that he was himself destined to build up out of those fragments a complete and systematic theory. Both these men, though each in his way more highly gifted than Pestalozzi, loyally acknowledged him as their master, and submitted to his influence in everything except living on friendly terms with each other. Schmid first seceded and wrote against the institution. When he had been prevailed upon to return, thirteen of the staff withdrew, and with them Niederer, whose desertion, and the circumstances which accompanied it, threw the old man into such a passion of grief and anger that he became delirious, and his reason only slowly returned. For he saw in Niederer 'the one man in the institution who, standing on the pinnacle of German culture, was fitted to gain for the new method its proper place in the region of human culture generally.' Only by such a man, he thought, could the educated world be won over to his plans; by such a man only must his Swiss idiom be translated into '*high* German,' nay, for some time he so far argued with Niederer as to think that 'Niederer understood him better than he understood himself.' And now began a money squabble, leading to a protracted lawsuit between Pestalozzi and the seceding teachers, which brought further discredit and pecuniary loss upon the institution, and poisoned all the remaining years of the old man's life. The lawsuit was decided at the end of seven years, and then Pestalozzi determined to transfer his institution from Yverdun to Neuhof, where he had made his first unsuccessful venture just fifty years before. But on his announcing his intention of doing so, the scholars and the remaining teachers refused to accompany him, and nothing was left for him but to close the school. This he did in 1825, and withdrew alone, impoverished, and widowed, at the age of eighty years, to end his days under the roof of his grandson. He had lost his devoted wife about eight years before this last blow. What a chequered life, but with how much more of shadow than of sunshine, must she have led for those five-and-forty years, with a husband capable of such tender attachment, such nobility of feeling, such exalted disinterestedness, but at the same time such an unkempt, thriftless, poverty-stricken, one-idea'd enthusiast as Pestalozzi! When the customary parting hymn had been sung before the closing of her coffin, Pestalozzi turned towards it, and said, 'We were spurned and despised by all; sickness and poverty bowed us down; we ate dry bread with tears. What was it that in those days of trial gave you and me the strength to persevere and not cast our hope away?' Thereupon he took up a Bible, and laid it on the breast of the corpse, and said, 'From this source you and I drew courage, and strength, and peace.'

Pestalozzi's constitution had been weak from childhood. He had undergone severe illnesses, and met with more than one all but fatal accident, yet he lived to drain the cup of a long and disappointed life, and died as heart-sick, and as nearly heart-broken, as it is possible for a brave and religious man to die. His last conscious moments however were lighted up with a parting gleam of his old brightness and serenity. Calling his friends to stand around his bed, he spoke to them thus: 'I forgive my enemies; may they find peace now that I go to everlasting rest. I should like to have lived another month, to have completed my last labours; but I again thank God, who in His providence calls me away. And you, my children, remain in quiet attachment to one another, and seek for happiness in the circle of home.'

He was buried in the little churchyard of Birr on the 19th of February, 1827. Scarcely any persons not of his own family attended his funeral, for the snow lay thick on the ground, and as the interment took place on the second day, the news of his death had reached a very few. But for some time afterwards it was the custom for school children and teachers of the canton of Argovia to come and sing their hymns over his grave.

In the next number some account will be given of Pestalozzi's system.

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

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No. XV.—THE MONKEY TRIBE.

PART III.

THE Macaques are all natives of Asia, and include several very well-known monkeys. One of the most familiar of these is the Bonnet Macaque, or Munga (*Macacus Sinicus*), of Bengal and Ceylon.

This monkey derives its popular title from the curious arrangement of the hairs upon the crown of the head, which radiate in such a manner that at a short distance the animal appears to be wearing a kind of cap, or bonnet. The colour of this macaque is an olive-grey.

Like the Entellus, the munga is considered as a sacred animal by the natives of the countries which it inhabits, and is protected accordingly, a place being always prepared in the temples for its habitation. The older and more savage the animal becomes the greater is the veneration in which it is held, no one being allowed to interfere with it in any way, in spite of any depredations which it may commit in the neighbouring villages.

The munga has often been brought to this country, but does not seem at all suited to a life of captivity, its temper being very capricious and revengeful. It does not appear to be nearly as susceptible to kindness as monkeys in general, and never entirely loses its sullen and fierce disposition.

Even in the Zoological Gardens, where the greatest care is taken of the animals, and the keepers are uniformly kind and gentle, the bonnet monkey is apt to be mischievous.

A few days before writing these lines, I noticed that there were seven specimens of the bonnet monkey in the house, and asked the keeper how they behaved themselves. In answer to my question, he showed me his hand, which is disfigured by a large and deep scar on the thumb and wrist.

This scar was the result of an attack made upon him by a large bonnet monkey. He was employed in his usual work in the cage, when, without being provoked or giving notice of its intentions, the animal suddenly flew at him, and before it could be removed, inflicted such terrible bites on his hand and arm, that he had to be taken to a hospital, and remain there for three months.

The well-known Magot, or Barbary Ape (*Macacus Innuus*) belongs to this group, and is remarkable as being the only monkey found in a wild state in any part of Europe. Even these creatures are confined to a single locality, namely, the celebrated Rock of Gibraltar, where they were once found in considerable numbers. Year by year, however, the Rock apes, as they are called, diminish in number, and, before long, will probably be extinct.

It does not appear to be an indigenous inhabitant of that neighbourhood, but would appear to have been imported at some former period from Barbary, where it is very abundant.

There is, however, another theory, namely, that in former times Europe and Africa were united by an isthmus, of which the Rock of Gibraltar formed the European end. The isthmus was by degrees cut away by the sea, and the apes at the European end, being loth to leave their comfortable quarters in the rock, were at last severed from Africa by the waves.

The magot is a very wary and cautious animal, and takes up its abode in the most inaccessible parts of the rock, where its movements can scarcely be observed excepting by the aid of a powerful telescope. Banding together in large flocks, its very numbers render it secure from all enemies, excepting the climbing *felidæ*, which steal upon it during the hours of darkness, and strike down the bewildered animals before they are fairly aware of the presence of their foe.

The magot is regarded with great disfavour by the owners of cultivated lands in the vicinity of its haunts, for it is in the habit of making occasional raids upon the growing crops, conducting these foraging expeditions with so much wariness and caution, that it is very seldom detected by the outraged farmer. Although feeding chiefly upon leaves and fruits of various kinds, it does not by any means confine itself to a vegetable diet, preying largely upon scorpions and insects of various kinds. These it captures by turning over stones, logs, etc., under which many small creatures are in the habit of taking refuge, and snatching them quickly up before they have time to make their escape. The 'Rock apes' have little to feed upon except scorpions, and this may account for their diminution.

It might be thought that the poisonous properties which the scorpion possesses would be quite sufficient to render it secure from the paws of the monkey. Such is not the case, however, the magot invariably twisting off the poison-bearing tail as soon as it seizes its victim, before the captive can find time to inflict a wound upon its pursuer.

While young, the disposition of the magot is docile and gentle, and it can be tamed without any great difficulty. But, as it increases in size, it almost invariably becomes harsh and sullen, just as do the apes under similar circumstances.

The magot is not a very large animal, its average size being about equal to that of an ordinary bull-terrier dog. Notwithstanding the slenderness of limb, the muscular power is wonderfully great, as, indeed, is the case with almost all the animals of the monkey tribe. Even in captivity, where its powers are greatly decreased owing to the narrow space in which it is confined, quite a small monkey may often be seen shaking its whole cage violently to and fro, a feat which would appear remarkable in an animal of double the size.

Nearly all the monkey tribe are fond of mischief, but the magot is perhaps the worst of them all in this respect.

Once I was admiring the graceful attitudes of some magots, when I noticed a lady standing very near the bars of the cage, wearing a new and very conspicuous bonnet, with abundance of flowers, beads, etc., upon it. I pointed out to her a printed warning that the monkeys were mischievous, but as none of them were near, she took no heed of the warning.

Several of the magots were gambolling on some rock-work in the background, while another, the oldest and most mischievous of the monkeys, was sitting apparently asleep on a tree stump in the middle of the cage.

But he was as wide awake as any of us, and was only watching his opportunity. Just as the lady turned round to leave the spot, the monkey sprang from the stump to the cage, and in a moment snatched the bonnet off her head, sprang back to the stump, and there began to investigate his prize.

The bereaved owner shrieked and scolded, but the animal took no heed of her, and with a serious and grave aspect began to resolve the bonnet into its constituent parts. First, he tore off the crown with his teeth, and then pulled out the flowers. Next came the beads, which the monkey hung here and there on the branches. Then he ripped off the veil, and twisted it over his head in mantilla fashion.

This last feat entirely destroyed the gravity of the spectators. Up to that time we had been trying to get the bonnet back, even in its dilapidated condition. But the aspect of that monkey, looking with air of wistful wonder through the veil, was too much for any one to endure, and there was a roar of laughter at the spectacle.

Owing to the very rudimentary nature of the tail, the magot has been considered by many writers to belong to the baboons, while others have ranked it with the apes. It is only of comparatively late years, indeed, that its true position has been satisfactorily determined.

The Pig-tailed Macaque, or Bruh (*Macacus nemestrinus*), a native of Sumatra and the neighbouring islands, is often brought, while yet young, under the dominion of man, and employed in a rather remarkable manner. Being remarkably active, even for a monkey, and possessed, moreover, of a considerable share of intelligence, it is trained to climb the lofty cocoa-nut palms in order to gather the fruit, which it hurls down to its employers beneath. After a short

time, it learns that only the ripe nuts are required, and accordingly selects the matured fruit alone, leaving the remainder to ripen upon the tree.

The last of the Macaques which we can now describe is the curious Wanderoo (*Silenus veter*), a native of the East Indies.

The appearance of this monkey is most remarkable, owing to the heavy mass of long hair upon the head. This hair surrounds the entire face, and falls in a long beard from the chin, giving to the animal the appearance of great age, which is much increased by the grizzled, or even white hue which it often assumes. The extremity of the tail is ornamented by a tuft of black hairs, which has earned for the animal the title of 'Lion-tailed Baboon.'

The wanderoo is regarded with very great respect by the natives, who state that it holds the foremost place among the monkeys of the same land, and that they treat him with the respect due from subjects to their sovereign.

The cheek pouches of the wanderoo are very large, and capable of containing a considerable amount of food. Before beginning a meal, the animal is in the habit of filling these pouches, in order to secure a supply of food in the event of being interrupted before its banquet is completed.

WE now come to the BABOONS, a group of animals whose distinguishing characteristics are very strongly marked. Their chief peculiarity lies in the form of the head, which is aptly described by the scientific title of '*Cynocephali*,' *i.e.*, 'dog-headed,' which has been applied to the group.

A mere glance at the position of the nostrils is sufficient to at once determine whether any monkey belongs to the baboons or not, for in these animals those organs are situated at the extremity of the muzzle, instead of lying flat upon the face, just beneath the eyes, as is the case with all the other members of the monkey tribe. The form of the muzzle, too, is rather remarkable, being abruptly terminated with a round and flattened extremity. All these animals are natives of Africa.

In the baboons, the semi-bipedal character of some of the foregoing monkeys almost entirely vanishes, the animals seldom moving, even for three or four steps, otherwise than upon all fours. They scarcely ever stand upright, indeed, except when upon the look-out for a foe, and even in such a case mostly steady themselves by resting one of the fore-paws upon some convenient object.

While their tactics, when molested, are rather those of defence than offence, the baboons are, nevertheless, very formidable foes, even to man himself, when once fairly brought to bay. Fierce, active, and powerful, their onset is by no means to be despised, and even a single baboon would prove a very terrible antagonist.

Their mode of attack is invariably the same. Leaping at the throat of its enemy, the baboon fixes its long, sharp teeth firmly in the flesh. Then, exerting the full strength of its powerful limbs, it thrusts its foe forcibly to arm's length, tearing its teeth completely through the throat of its victim, and so causing a terrible, and often a deadly wound. In this manner, it is in the habit of repelling the attacks of the hounds employed in its pursuit, galloping on until one of the dogs outstrips its fellows, and suddenly turning and attacking its foe before the latter is able to defend itself. A brief struggle, and the hound lies dying upon the earth, while the baboon rushes on as though nothing of the kind had taken place.

Curiously enough, the hounds do not seem to learn by experience the danger of attacking so formidable a foe, but start eagerly upon the track of a baboon in preference to that of other game.

All the baboons are capital climbers, whether of rocks or trees, from the neighbourhood of which they never stir to any great distance. They are always found in bands, which unite their forces if any danger appears, and, by their mere numbers, bid defiance even to the larger and more savage *carnivora*.

The first, and one of the most remarkable in appearance of the baboons is the Gelada (*Gelada Ruppellii*), of Abyssinia, an animal which has been assigned to a separate genus on account of the peculiarly tufted tail.

The extraordinary aspect of the gelada is chiefly owing to the heavy mass of thick, long hair which covers the neck and shoulders, and which bears an absurd resemblance to the fur tippets so frequently worn by coachmen during cold weather. Upon the young gelada this mass of hair is scarcely visible, the mane, if we may so call it, not attaining its full dimensions until the growth of the animal is complete.

The most widely known of all the baboons is the Chacma (*Cynocephalus porcarius*), of Southern Africa, an animal which is found in great numbers in rocky and broken ground.

The chacma is a terrible foe to agriculturists, making systematic raids, under cover of night, upon the crops in the neighbourhood of its haunts, in spite of any precautions which may be taken by the aggrieved owner with a view to preventing the ravages of his active foes. These raids are always undertaken by a large band of baboons, and are managed in a singularly ingenious manner.

The cunning animals appear to know by instinct that, if the whole number enter the forbidden premises, they must inevitably be detected by the dogs which are keeping watch. So the actual robbery is conducted by two or three of the oldest and most experienced baboons only, who silently climb the fence and make their way to the trees which bear the coveted fruit.

Meanwhile, the remainder of the band form themselves into a long line, reaching from the plantation to their private haunts, a space of a few feet intervening between each animal.

This being done, the chacmas which have been deputed to enter the orchard hand their spoils to the nearest comrade upon the other side of the fence. He hands the booty to No. 3, who in turn passes it to No. 4, and so on until it is safely deposited in the larders of their rocky home. As soon as a sufficient quantity has thus been collected, the baboons leave the orchard as quietly as they entered it, and proceed to revel upon the results of their labours.

When quite young, the chacma is often taken by the natives, and trained to render them a very important service when occasion requires. This consists in the discovery of water in times of drought, for, strange to say, the chacma appears to possess a natural aptitude for finding hidden springs, even when they are concealed at some distance beneath the surface of the ground.

When water shows signs of running short, the

chacma is kept without liquid for twenty-four hours, and its thirst increased by the administration of salt. A long rope is then fastened to its collar, and the animal allowed to take its own course, its master following closely upon its track.

The baboon runs forward a little; then stops, and sniffs the ground; runs forward again; again stops, and so on, every now and then tearing up a blade of grass, or a weed, and carefully smelling it upon all sides. So it goes on, carefully inspecting every likely spot, until, sooner or later, it is almost sure to lead its captors to the wished-for spot. The animal is also employed in searching for roots, etc., which it digs out of the ground by means of its long nails.

The chacma is thought to be a rather long-lived animal, its existence being calculated at about forty years.

Another well-known baboon is the Papion (*Cynocephalus Sphinx*). In former times this animal was regarded with great reverence by the Egyptians, provided with a home in their temples, and its body carefully embalmed and preserved after death. The mummied forms of many of these monkeys have been found in the caves of Egypt, having evidently been prepared with the same care and attention devoted to the corpses of human beings.

The most grotesque, as far as appearance is concerned, of the baboons is the Mandrill (*Papio Maimon*), a native of Guinea.

The body of this baboon is ornamented with almost every colour of the rainbow, arranged chiefly upon those parts of the body where such decoration would least be expected. Thus a patch of brightest blue adorns either side of the nose, which is swollen into two large projecting masses just beneath the eyes. These prominences are deeply grooved, and are variegated with lines of scarlet and purple alternating with the blue. The extremity of the muzzle is of a brilliant crimson.

The hinder quarters are also liberally decorated with rich carmine and purple, the mass of colour giving a very strange appearance to the animal. This is greatly increased by the projecting cheek-bones, which are even more protuberant than is the case with monkeys in general, and impart an expression of great brutality to the face.

Nor does the countenance belie the disposition of the animal, for of all the monkey tribe scarcely any is of so sullen and ferocious a nature as is the mandrill. It is liable to sudden and uncalled-for fits of passion, in which the animal seems literally carried away by its own fury. More than one instance has been known where the wild rage exhibited by the mandrill has been too much for the powers of the mind, the animal falling dead from the very violence of its own passions.

Naturally, such an animal is scarcely fitted for a life of captivity, the specimens which have been taken alive proving, except in a few isolated instances, utterly savage and untameable. There are few creatures, indeed, which seem so little amenable to kindness, care and attention appearing to be utterly thrown away upon this animal.

The mandrill is one of the largest of the baboons, an adult male measuring, when fully erect, nearly five feet from the crown of the head to the sole of the foot. In this country, however, the animal seems never to attain to its full dimensions, in common with almost all the members of the monkey tribe, seldom exceeding an ordinary terrier dog in size.

Its strength is wonderfully great, even for a monkey, and an angry mandrill would be far more than a match for an unarmed man. The natives dread it so greatly that they will not even enter the woods where it resides, except in large and well-armed bands.

The food of the mandrill, in common with the other baboons, is chiefly of a vegetable nature, varied with centipedes, scorpions, insects, and other small creatures. It is sometimes, however, known to attack larger game, and to prey upon birds, reptiles, and the smaller quadrupeds. Like the wanderoo, it usually fills its cheek-pouches before commencing its banquet, in order to make certain of a second meal if the first should happen to be interrupted.

The fur of the mandrill is of an olive-brown hue, becoming grey upon the under side of the limbs. Upon the chin is a pointed yellow beard. The gorgeous colours with which the face and the hind-quarters are adorned are seen in their full perfection only in the adult male, the female having the blue patches upon the muzzle alone, and even those being of a paler hue than in her mate. These brilliant hues appear to be dependent upon the health of the animal, becoming dimmed if their possessor be at all out of condition. After death they entirely fade away, the skin becoming of an uniform black colour.

The Drill (*Papio Leucophæus*) is also a native of Guinea, and is frequently confounded with the mandrill, from the young of which animal it can with difficulty be distinguished. Consequently, we know very little of its habits when in a wild state, few travellers having discriminated between the two species with sufficient exactness to furnish us with a trustworthy account of its mode of life.

This baboon is devoid of the brilliant patches of colour which adorn the last-described baboon, the protuberances upon the face being also very much less strongly marked. In other respects it is not at all unlike the mandrill, and we can scarcely wonder that the two animals have so often been confounded with one another.

All the foregoing animals appear to possess a very good notion of the power of combination as a means of defence against their enemies. There are few animals which will dare openly to attack a flock of baboons, even the lion itself considering, in this instance, discretion to be the better part of valour, and prowling round the outskirts of the band in the hope of snatching up some straggler.

When upon the march, they travel in an almost military manner, the young males being placed in the van, and deputed to survey the ground over which the band is to travel, the females and young in the centre, while the older and more experienced males bring up the rear.

We must now bid farewell to the baboons, to proceed to the curious groups of monkeys which are found in the American Continent.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

THE following is an outline of a lesson given to boys in Standards V. and VI., on 'Attraction of Gravitation,' 'Gravity,' and 'Weight.'

In our lesson upon 'Energy' one of you boys, I think it was Howell, made a remark about the water flowing down the mountain. Do you remember what you said was the cause of the water coming down? Ans.—I said that the man knocked away the wall that kept the water up, and so it all rushed down. Ah, yes; but I think you gave some reason for the water coming down after the wall *was* broken down. Ans.—No, sir; I don't remember. (A boy, Smith)—It was I, sir, who said it was the attraction of gravitation that made the water come down. So it was, Smith. Well, I want to have that point cleared up this morning. (A boy putting up his hand.) Well? Please, sir, if the man hadn't broken down the wall the attraction of gravitation wouldn't have made the water come down. (Another boy)—But if the man *had* knocked away the wall, and there had been no attraction of gravitation, the water wouldn't have come down. (A boy, Jones)—What *is* the attraction of gravitation? Ah, that is what I want to make clear. We have often spoken about the attraction of gravitation: now what *is* it, think you? Ans.—The power the earth has of drawing everything to it. Is it only the earth that has this power you speak of? No, sir; other things have; the moon has. Indeed? Ans.—Yes, sir: Mr. Allen said the moon attracted the water of the earth, and so caused the tides. (A boy)—No; Mr. Allen didn't say that. He said it was just as true to say the water attracted the moon as to say the moon attracted the water. (Another boy)—It says in our books that *all* the earth attracts the moon. And does it? Ans.—Yes, sir: if it did not, the moon would fly away from the earth. (A boy)—Where would it fly to? (Previous boy)—To the sun. Why do you think it would fly to the sun, Smith? Ans.—Because the sun is so much bigger, and would attract it; and if the sun didn't attract the earth, that would fly away too. Now stop a minute, boys, and see where we are getting to. One boy says the water comes down the mountain because the wall is broken down; another boy says it is because the earth draws it down; another, that the earth attracts the moon; another, that the moon attracts the earth; and yet another, that the sun attracts the earth. Now what do you mean by 'attract'? Ans.—'To draw to,' or 'to pull.' Very good. Here is a piece of chalk in my hand. I let go my hold upon it. You see it falls. You think you know a cause for that falling, do you not? Ans.—Yes, sir; we do know. Do you? What is it? Ans.—The earth draws it. Indeed, does it? Come here, Cox. Now you see I have taken this boy by the hand, and am pulling him after me all over the room. Why did Cox follow me about in this way? Ans.—Because you pulled him—you forced him to go. Yes, I exerted a force: what was the name of that force? Ans.—Muscular force. Now do you mean to tell me that the earth was pulling at that piece of chalk somewhat in the same way that I was pulling at Cox? Ans.—Not in the same way, because the earth has no muscular force. Just so; but has it any other force to pull? No answer? Ah, you don't know whether it has; nor do I; nor does anybody else. (A boy)—The earth draws because of its attraction. Indeed? You just said 'attract' means 'to draw;' so now you say the earth attracts because it attracts. What sort of reason do you call that? Ans.—A rather stupid one. Yes, I should think so. All we know about the chalk is this: it falls to the earth when there is nothing to keep it up; and when there *is* something to keep it up it still tries or tends to fall. Whether the earth is drawing it or not we do not know. And so the water on the earth, and the earth itself, tend to fall to the moon, and the moon tends to fall to the earth, and the earth tends to fall to the sun; and what can we say about everything on the earth? Ans.—Everything tends to fall to the earth. We have a word which is the name of this general tendency. I will write it on the board: 'Gravity.' Now what do we understand by gravity, so far as our earth is concerned? Ans.—The tendency of everything to fall down. Fall down? Ans.—Yes. Ah, we must be careful about saying 'fall down.' Suppose a chimney-pot fell off this school, where would it fall? Ans.—Down to the ground. Well, and suppose a chimney-pot fell off a school in New Zealand, where would it fall? Ans.—Down to the ground there. Just so; but would the two fallings be in the same direction? Ans.—No, sir: quite opposite. Very well; so that 'down' in New Zealand would be 'up' here in England. Hence we had better not say 'down:' we will only say 'to the earth.' Now I will again ask the question we started with. Why does the water run down the mountain? Ans.—Because it has a tendency to fall. Just so; *that* is all we can say about it; and what is the name of this tendency? Ans.—Gravity. (A boy)—Please, sir, can't you say the earth has a tendency to draw the water to it? That is a very fair question, Smith: you would rather say the earth has a tendency to draw the water than that the water has a tendency to fall to the earth. (Smith)—Yes, sir; and I would call this tendency the attraction of gravitation. Very well. Now let us talk a little about what Smith says. Some time ago a man went to a mountain near Edinburgh and hung up a large weight by a long string. He then found that the string did not hang quite straight: it inclined a little towards the mountain. (Smith)—Yes; that was because the mountain attracted the weight. (Another boy)—No; it was because the weight had a tendency to fall to the mountain. (Another boy)—Please, sir, that's all the same thing. Stop a minute, boys: I don't think that *is* all the same thing. Do we see that every single thing has a tendency to fall to the earth? Ans.—Yes, sir; everything. Very well; then we can be quite certain about that tendency. Now do we see that the earth draws everything? Ans.—No, sir. (Smith)—But we can suppose it does. Ah, now we are coming to the point. Your 'attraction of gravitation,' Smith, is only a supposition. We really know nothing about it. But what of 'gravity'? Ans.—We are certain of it. Yes; it is a fact that everything has a tendency to fall. Now we will get on. Has everything the *same* tendency to fall? For instance, here is a lump of lead; here is a piece of wood. I let go. Do they both fall with the same

force? Ans.—No, sir: the lead falls heaviest. What do you mean by 'falling heaviest'? Ans.—Strikes the ground the hardest. Very well. Here is a small piece of wood; here is a large piece. They fall. Which falls the heavier? Ans.—The large piece. Yes; we could say the lead has a greater tendency to fall than the wood, and the large piece of wood a greater tendency than the small piece. Now I should like to measure this tendency; to say, for instance, what amount of tendency to fall there is in the lead or in the wood. Is there any way of doing this? No answer? Well, look. This piece of wood weighs six pounds, and this piece one pound. You said this large piece of wood has a greater tendency to fall than the small piece. How much greater? Ans.—Six times as great. Why do you say so? Ans.—Because it weighs six times as much. Then you think the weight of a thing is the measure of its falling tendency? Ans.—Yes, sir. Then shall we say 'weight is a measure of gravity'? Ans.—Yes, sir. (A boy, Howell)—No, sir. Ah, Howell says 'No.' Why not, my boy? (Same boy)—Because I have got down in my exercise-book that weight is a measure of the amount of matter there is in anything, or a measure of mass. Here it is, sir (showing the book). It was in your lesson upon matter. (Another boy)—Yes, sir; I have written that too. Just so. Now the question is, What *is* weight? (Smith)—We know what weight is. Do you? (Same boy)—Yes, sir; it is the amount of gravitation acting upon a body. I have read that in a book. But, Smith, we have decided that your attraction of gravitation is only a supposition. Are you going to measure a supposition? (Same boy)—Then weight is a measure of gravity. Very well, Smith; but Howell says it is not. We will inquire. What do you mean by saying this piece of wood weighs six pounds? Ans.—We mean that there are six pounds of matter in it. (A boy)—Couldn't you say the gravity of it was six pounds? (Another boy)—That would be very silly. How could you have six pounds of 'tendency'? You *can* have six pounds of matter. (Howell)—Please, sir, the tendency to fall depends upon how much matter there is in anything. Ah, now, boys, we are getting near the truth. What word have I given you for 'quantity of matter'? Ans.—Mass. And for tendency to fall? Ans.—Gravity. What does gravity depend upon? Ans.—Mass. Just so. The greater the mass—(ans.) the greater the gravity. The less the mass—(ans.) the less the gravity. And what is the measure of mass? Ans.—Weight. Yes, and we will keep it so. Now tell me why the gravity of this large piece of wood is greater than that of the small piece. Ans.—Because it is a greater mass. Why is the gravity six times as great? Ans.—Because there is six times as much mass. How do you know that? Ans.—Because it weighs six pounds, and the other weighs only one pound. Very good. Now, my boys, we have been using these words hitherto with no very definite meaning. We can't settle everything in one lesson, you know: we must travel step by step. But after to-day, whenever we use those terms, we will mean exactly what I am now going to tell you to write in your exercise-books, which you may now take out. Gravity is the tendency of every mass of matter to fall towards every other mass. Attraction of gravitation is a name given to a supposed cause of this tendency. Weight is a measure of mass.

This concludes all I have to say upon the second stage, Mechanics. Next month I will give a detailed syllabus of the third stage.

'How I Teach Arithmetic.'

(*Continued from page 76, vol. II.*)

BY WILLIAM SPENCER,
Author of 'Spencer's Exercises in Arithmetic.'

As the above five sub-divisions (*d*) contain, at least in principle, every conceivable form in which a question can be presented, boys should be encouraged to look at the principle on which any such question is based, rather than to work by any formal rule, which is far more likely to be applied wrongly than rightly. As I have before remarked, the working here presumes a thorough knowledge of fractions, supposed to have been obtained before commencing percentages. Scores of questions, coming promiscuously under any of these subdivisions, should now be given, alternating with those previously given, under any other branch of percentages,—interest, discount, etc. We will close our remarks on profit and loss by working out a somewhat difficult question taken from my exercises in 'Percentages' (No. 160):—A corn dealer had 550 quarters of wheat, for which he was offered £2 11s. 6d. a quarter; he kept it 6 months, and then sold it at £2 13s. 9d. a quarter. What did he gain or lose by keeping it, reckoning money at 5 per cent. per annum, the wheat having lost ½ per cent. by measure, the charge for warehousing, etc., being 7¾d. per quarter on the original quantity. First, £2 11s. 6d. = £2·575, which × 550 = £1416·25 what the wheat could have been sold for (say on January 1st) six months before it *was* sold. Second, 550 quarters less ½ per cent., that is $\frac{1}{200}$ of itself, = 550 − 2·75 = 547·25 quarters actually sold (say on July 1st), and (£2 13s. 9d. =) £2·6875 × 547·25 = £1470·734375 amount actually sold for. Third, had it been sold on January 1st, the amount received, 1416·25 would have been at interest for the six months ending July 1st, making £1416·25 ÷ 40 (5 per cent. for a year being $\frac{1}{20}$, hence, for half a year, $\frac{1}{40}$) = £35·40625; hence, had the wheat been sold on January 1st, the amount received on account of it on July 1st would have been £1416·25 + £35·40625 = £1451·65625. Fourth, £1470·734375 − £1451·65625 = £19·078125 = £19 1s. 6¼d.; from this (fifthly) must be deducted the cost of warehousing, etc., which equals 7¾d. × 550 = 4262½d. = £17 15s. 2½d. Hence, £19 1s. 6¼d. − £17 15s. 2½d. = £1 6s. 4¼d. *gain* by keeping the wheat. Ans. As each step of the above seems tolerably plain and followable, we make no further remarks on it.

(*e*) *Commission, Brokerage, Insurance, etc.*, comprise the simplest form of percentages, requiring very little thought and being easily worked. The terms should be first defined, *Commission* being an allowance per cent. for receiving, collecting, paying, etc., of any sum of money. *Brokerage* might be defined as an allowance per cent. for buying and selling goods, etc. The two terms, however, are gradually becoming synonymous and interchangeable. *Insurance* tacitly reveals its own meaning to an adult, but the nature of insurance—fire, life, etc.—might be cursorily touched upon to a class of boys. Examples:—

e.g. (1st) Find the commission on £3752 12s. 6d.

at 1½ per cent. £3752 12s. 6d. = £3752·625 = 37·52625 *hundreds* of £'s, then 1½ × 37·52625 = £56·289375 = £56 5s. 9$\frac{9}{20}$d. Ans.

e.g. (2nd) What is the brokerage on £4363 5s. at 4s. 6d. per cent.? £4363 5s. = 43·6325 hundreds of £'s, then 43·6325 × 4½ = 196·346255. = £9 16s. 4$\frac{31}{100}$d.

e.g. (3rd) Find the premium for insuring a building worth £7847 10s. at 5s. per cent. As 5s. is ¼ of a £, it is $\frac{1}{100}$ of a hundred £; hence the amount of premium will be £7847 10s. ÷ 400 = £19 12s. 4½d. Ans. The word 'premium' as used in insurance business should be explained.

e.g. (4th) The amount paid for insuring a warehouse at 3s. 9d. per cent. is £11 18s. 1½d., find for what sum it is insured. The building must be insured for as many £100's as there are 3s. 9d.'s in £11 18s. 1½d. Bringing both to three-halfpences we have 1905 ÷ 30 = 63½ hundred £'s = £6350. Ans.

e.g. (5th) A machine being sold for £124 10s, an agent received as his brokerage £9 6s. 9d.; what was the rate per cent.? As £100 is $\frac{200}{249}$ of £124 10s., and as £9 6s. 9d. = £9$\frac{27}{80}$ = £$\frac{747}{80}$, then $\frac{200}{249}$ of £$\frac{747}{80}$ = £7½. Ans.

e.g. (6th) For what amount must a ship worth £9800 be insured at 2 per cent., so that if she be wrecked the value of the ship and the premium may both be recovered? (*Spencer's* Percentages, No. 113). Questions of this nature I generally find a sore puzzle to examinees; the principle upon which it is based may be explained, however, by showing that every £100 insured must include the rate per cent. of insurance:—thus, if the rate be 1 per cent. then every £99 of value in the ship must be insured for £100, if the rate be 5 per cent. then every £95 for £100, and in the given question as the rate is 2 per cent. then every £98 must be insured for £100. Then £9800 ÷ 98 = 100, the number of £'s 98 in the value of the ship, and as each of these hundreds must be insured for £100, hence £100 × 100 = £10,000 Ans. Here explain clearly that the amount paid for insurance would be £2 × 100 = £200, which, with the value of the ship (£9800 + £200) = £10,000. The above will, it is hoped, suffice for this branch of percentages.

One of the most important, if not *the* most important, branches of percentages is *(f) Stocks, Shares, Debentures*, etc., my mode of teaching which I will now explain. First as to Stock, or as it is more commonly used in the plural form—Stocks. By this term we generally understand money borrowed by some nation, in sums of £100, for which the nation through its representatives promises to pay a *fixed* rate of interest, irrespective of any rise or fall in the value of money. The length of time for which the money is borrowed is sometimes for a definite number of years, but far more generally without any period being specified,—in fact in perpetuity. But although the money thus invested cannot be withdrawn at the will of the investor, he can sell or transfer the right to receive the fixed interest to a third party. This transfer is daily going on, so stocks and shares are constantly changing owners, the same as any other kind of property.

I should illustrate as follows:—Suppose our own or some other national government finds it inconvenient to raise as much revenue in any (say) year as will meet its expenditure, as in time of war or other emergency, it has recourse to borrowing. Suppose ten millions sterling were borrowed at 4 per cent., and that I lend £100 towards it. I receive a document stating that the nation owes me £100, for which it will pay me £4 a year, or more frequently £2 each half year. After a while I want my money for some other purpose, and supposing money to be of the same value, that is, will bring in the same rate of interest, I can most probably through some stockbroker sell out my £100 stock for £100, I giving up the document I received to the buyer, and with it of course the right to receive the interest. The buyer would now for a small fee, be registered on the government books as the owner of what was previously my £100 stock. Suppose, however, that the value of money has risen to 5 per cent. when I wish to sell out, then nobody would give me £100 for the right of receiving £4 interest; but I might sell it for £80, as if £80 makes £4 interest, it is at the rate of 5 per cent. On the other hand, should money be cheaper, that is at a lower rate of interest, I might be able to sell for more than £100. If money were only making 3 per cent. interest I could get £133⅓ for it, as it would require £133⅓ at 3 per cent. to make £4 interest. Here I have supposed that the *security, continuance of payment*, etc., remained the same, since the rise and fall in the price of stocks will depend on these contingencies as well as on the rate of interest obtained. The price will be affected also as to the amount of interest that has accrued at the time of transfer, whether just after the interest has been paid (when such fact is expressed in share lists by *x. d.*—ex dividend), or when more or less interest has accumulated. Of course the price will be lower *x. d.*, and higher when the dividend is nearly due.

We will now work out a number of questions embodying the various principles and operations that can ordinarily occur. (1) *e.g.* What annual income should I get by laying out £3564 in the purchase of 3 per cent. stock at 81? Here explain that £100 nominal stock can be bought for £81, showing that money is dearer now than when £100 only made £3 interest, that is, that £81 would now make £3 interest. At the commencement this requires to be clearly impressed on the minds of the scholars, otherwise they fail to see the difference between the real and nominal value of the stock. Line upon line is here required, as a boy seems to think that a £100 (nominal) must always be worth £100 (real). We see the same lack of perception even in adults often, as who has not heard the remark concerning some individual who has stock or shares in a concern that is going to the bad, 'he should take his money (in full of course) out of it'? Of course 'he' should not lose anything whoever else did. To return from this digression, as £81 invested makes £3 interest, then as many times as £81 is contained in £3564 will give the number of £'s 3 interest;—hence 3564 ÷ 81 = 44, the number of £'s 100 worth of stock bought, and as each £100 (nominal—really cost £81) makes £3 interest,—£3 × 44 = £132. Ans. Having finished the working of this *first* question, I would ask every conceivable question respecting it:—How much money is invested? What principal invested makes £3 interest? Here some will say £100; again explain that £81 invested makes £3. As an alternate method of working the question show that as £81 makes £3, then £81 ÷ 3 = £27, the principal required to make £1 interest; hence £3564 ÷ 27 = £132. Ans.

(2) *e.g.* What sum must be invested in the 3 per cents. at 94¼, to yield an income of £750 a year? Here first elicit that £94¼ makes £3 interest; but we require a principal to make £750 interest, hence £750 ÷ £3 = 250, the number of £'s 94¼ required; then £94·25 × 250 = £23,562 10s. Ans. The above appears so simple as to require no further explanation.

(3) *e.g.* How much stock at 92½ can be bought for £23,712, a commission of ⅛ per cent. being charged on the stock purchased? £92½ + £⅛ = £92⅝ cost to the buyer of £100 stock. Here explain again that the stock is below its nominal value—£100, which is called *par*. Show plainly that when the nominal value and cash value are alike, stocks are said to be at *par*. Here £100 worth of stock can be bought for £92⅝, hence the number of times that £92⅝ will go in £23,712 will give the number of *hundred* pounds of stock bought; then (£23,712 ÷ £92⅝) = (189,696 ÷ 741) = 256 hundred, and 256 × 100 = £25,600. Ans. Here call attention to the fact that more stock can be bought than the money invested, £25,600 worth for £23,712, as the price was below par, £92⅝ for £100 worth. Explain again that at some previous period this £100 has most probably cost somebody £100, but the price has now fallen to 92⅜. I say most probably, because either now or afterwards, I should explain that stocks are often *first* issued below par, say £91½ for £100; and sometimes even above par, say £102½ for £100.

(4) *e.g.* If I lay out £1,000 in the 3½ per cents. at 96, what should I lose by selling out at 95? (*Colenso*, Stocks, No. 9.) Here, as no interest or dividend is to be reckoned, the '3½ per cents.' is just a little 'dust' to be brushed away, being no use, but rather a hindrance to working the sum. As £100 stock can be bought for £96, then £1,000 ÷ £96 = 10 5/12 the number of cents. of stock bought. As the buying price is £96, and the selling price £95, then £1 must be lost on every £100 worth of stock bought. Now, 10 5/12 hundreds of stock were bought, then the loss is £10 5/12 = £10 8s. 4d. loss. Ans.

(5) *e.g.* A person transfers £11,000 from the 4 per cents. at 92 to the 5 per cents. at 110; what is the difference in his income? (*Colenso*, Stocks, No. 12.) He has £11,000, that is 110 *hundreds* of 4 per cent. stock, hence it is making him £4 × 110 = £440 a year. He now sells out at 92, hence £92 × 110 = £10,120, the cash received for £11,000 worth of 4 per cent. stock. Then £10,120 ÷ £110 = 92 *hundreds* of 5 per cents. bought. Then £5 × 92 = £460 interest derived from the new investment, hence £460 − £440 = £20 gain. Ans. Now question closely the steps gone over in working this question. First, the interest the money made in the 4 per cents., £440 a year; second, the amount received on selling out, £10,120; third, how much 5 per cent. stock bought, 92 cents.; fourth, the interest this makes, £460; fifth, the gain per year, £460 − £440 = £20. Ans.

(6) *e.g.* A person invests £18,150 in the 3 per cents. at 90¾, and, on their rising to 91, transfers it to the 3½ per cents. at 97½; what increase does he make thereby in his annual income. (*Colenso*, Stocks, No. 14.) First cause the class to notice carefully the difference of expression between the beginning of the two questions. In the last question the person *held* the stock and then transferred it; here we have a preliminary step the first stock being to *purchase*, and then afterwards to transfer. Show thoroughly the difference between these two expressions before proceeding to work the question. £18,150 ÷ 90¾ = 200 cents. of stock bought; then £3 × 200 = £600 yearly interest from the 3 per cents. £91 × 200 = £18,200 amount obtained on selling out, which is £50 more than was invested. Show that this is easily seen at a glance to be correct, as he gains (91 − 90¾ =) £¼ on each cent. of stock bought; and as 200 cents. were bought, £¼ × 200 = £50, the gain on selling out. Again, £18,200 ÷ 97½ = 186⅔ cents. of 3½ per cent. stock bought; hence (£3½ × 186⅔) = (7/2 × 560/3 = 3920/6 = £653⅓ = £653 6s. 8d.; and £653 6s. 8d. − £600 = £53 6s. 8d. gain. Ans. Again call attention to the fact that this question is precisely similar to the last, except the preliminary step as previously pointed out, there being six steps instead of five, which again carefully enumerate.

(7) *e.g.* By selling out from the New Zealand 5 per cents. at 103½, and investing in the Queensland 6 per cents. at 112½, an increase of £4 17s. 6d. income was obtained. What was the amount of stock sold out? (*Mansford*, Misc. No. 17.) We will first find what interest £100 N.Z. stock sold out will produce when invested in Queensland stock. It sells for £103½, and as 112½ will make £6 a year, the interest obtained will be 103½/112½ = 207/225 of £6 = £5 13/25. That is, as the N. Z. stock was only 5 per cent., £13/25 additional yearly interest will be made on every £100 sold out. But the total gain in interest is £4 17s. 6d., or £4 7/8, hence (£4 7/8 ÷ 13/25) = (39/8 × 25/13) = 9⅜ hundreds, which being multiplied by 100 will give £937 10s., the amount of N.Z. stock sold out. Ans. Here point out again that, as we are to find the amount of stock sold out, we must naturally find first what *any* given amount would make when transferred, the simplest amount, of course, being £100. Impress well that this £100 before transfer made £5, but that it now makes over £5½. Thorough oral explanation will always pay well in results.

(8) *e.g.* A sum is laid out in the 3 per cents. at 89⅜, and a half year's dividend received upon it; the stock being then sold at 94⅜, and the whole increase of capital being £54, find the original sum laid out. (*Colenso*, Stocks, No. 19.) This question, in its general features, is somewhat similar to the last, with, however, some points of difference. As in it, we will make £100 stock bought the base of operation, the cost of which is £89⅜. The *half* year's interest will be £1½, pointing out here clearly again that it is reckoned on the £100, not on the price given for it, the interest being a fixed rate on the nominal or original issue, irrespective at what price the stock changes owners. Then 94⅜ + 1½ = £96⅛, the full amount, including interest and selling price, obtained for every £89⅜ invested; hence £96⅛ − £89⅜ = £6¾, the profit got on every £100 worth of stock bought. Then £54 ÷ £6¾ = 8, the number of *hundreds* bought, and as £100 stock cost £89⅜, then £89⅜ × 8 = £715. Ans. Here mark well the distinction between the money actually invested, £715, and the stock bought, £800.

(9) *e.g.* The sum of £1001 was laid out in the 3 per cents. at £89⅜, and a whole year's dividend having been received upon it, it was sold out, the whole increase of capital being 72 guineas; find at what price it was sold out. (*Colenso*, Stocks, No. 20.) First step—£1001 ÷ 89⅜ = 11⅛ cents. of stock bought;

second—£3 × 11½ = £33 12s., the year's dividend; third—72 guineas = £75 12s., the *whole* increase of capital, and as £33 12s. of this consists of the year's dividend, then £75 12s. − £33 12s. = £42, the gain on selling out—that is, on selling 11½ cents. of stock; hence, fourth step—£42 + £1001 = £1043, the cash received for sale of 11½ cents. of stock; then, fifth—£1043 ÷ 11½ = 93⅛. Ans.

(10) *e.g.* What ought to be the price of £100 of bank stock which pays a dividend of 10¼ per cent., in order that it may pay 4 per cent. on the money invested? (*Spencer's* Government Questions, No. 130.) As £100 is required to make £4 interest, the principal required to make £10¼ interest must be (10¼ ÷ 4 =) 2⁵⁄₁₆ of £100 = £256¼. Ans.

(11) *e.g.* Bank stock paid 5¼ per cent. A person, after the deduction of 4d. in the £ on her dividend, received £25 16s. 3d. How much Bank stock did she hold? (*S.* G. Q., No. 219.) She paid 4d. in the £, that is, ⅓₀ of her gross dividend, in tax; hence, £25 16s. 3d. is ⅔₀ of the gross dividend; then (£25 16s. 3d. ÷ 59) × 60 = £26 5s., the full dividend. As £100 makes £5¼, then £26 5s. ÷ £5 5s. = 5 *hundreds* of stock held, that is, £500. Ans. Each step of the above seems so natural as to require little further iteration.

(12) *e.g.* A railway paid 4½ per cent. on capital, when its weekly receipts were £23 per mile, and 3½ per cent. on capital when its weekly receipts were £20 per mile. How much capital per mile was involved, supposing the working expenses per mile to be the same in both cases? (*S.* G. Q., No. 218.) This question, though somewhat formidable to look at, can be worked mentally in a few seconds. Thus, as £3 deduction in recepts per *week*, that is, £156 a *year*, makes a difference of one per cent. in the dividend, then £156 must be ⅟₁₀₀ of the capital involved in each mile, hence £156 × 100 = £15,600. Ans.

As one or other of the above twelve questions involves every phase under which *stocks*—that is, where the capital, of whatever kind, is held in nominal sums of £100—generally present themselves, we will now peruse *shares*, etc., held in other nominal amounts. Having the first division of my first class, consisting of about thirty scholars, before me, I should proceed to make some general remarks respecting the mode in which great undertakings, requiring considerable capital, are carricd out. I should instance railways, canals, docks, banks, large manufacturing or shipping companies, etc., and should remark that in some countries these are undertaken and carried on by the Government, but that in the British Isles these are left to private enterprise. As the amount of capital required is generally more than one person has at command, a number of persons join in finding the money, and share *pro rata* in the profits—or losses. These combinations are called joint-stock companies, and trade under some specific name or title. I here explain ordinary shares, preference shares, debentures, etc., each company being authorized by Parliament to raise a certain amount of capital as above, and no more. We will work out a few questions, and comment freely where necessary.

1st Example. The share capital of a dock consists of 50,000 ordinary shares of £40 each, 25,000 preference shares of £40, having a prior claim of 4½ per cent., and half a million sterling in 4 per cent. debentures;—the yearly net profit amounts to £185,000. Find the dividend on each ordinary share, and the rate per cent. The debentures have the first claim, and must be paid half-yearly, or yearly, or the liability continues as a debt—if unable to pay in any given period—claimable on future earnings. The interest required on these debentures is £500,000 ÷ 25 = £20,000. Preference shares have generally only a claim for any specific year, the liability not being carried forward to future years as in the case of debentures. Sometimes, however, this claim does extend to future earnings, all depending on the explicit terms on which the capital was raised. The interest required for these preference shares is £40 × 25,000 = £1,000,000 the preference capital, which at 4½ per cent. = £45,000. Then the amount of dividend to distribute among the ordinary shareholders is £185,000 − (£20,000 + £45,000) = £120,000. As there are 50,000 of these shares, then £120,000 ÷ 50,000 = £2 8s. per share dividend. Ans. Hence, as £40 makes £2 8s. dividend, £100 makes 2½ times £2 8s. = £6 per cent. Ans. I should now go over the work as exhibited on the board, twice or three times, and question exhaustively on the operations performed.

2nd Example. Which is the more profitable investment—to buy £100 railway shares at 125, or £6 bank shares at 9⅜, the railway paying 6¾ per cent. dividend, and the bank 7½ per cent? (*S.* G. Q., No. 57.) Of course the dividends per cent. given are on the nominal value of the shares, if not so there would be nothing to find, as 6¾ and 7½ would be the answers. I make this remark, because one examinee, at least, when the question was given at Christmas 1875, "could see nothing to answer." In the case of the railway shares, as £125 makes £6¾ interest, then £100 makes ⁶⁷⁵⁄₁₂₅ or ²⁷⁄₅ of 6¾ = ⅘ of ²⁷⁄₄ = 5⅖ per cent. Ans. Again, the £6 bank shares pay 7½ per cent. on their nominal value (£6), but as they cost £9⅜ they will only pay $\frac{6}{9\frac{3}{8}} = \frac{48}{75} = (\frac{16}{25}$ of $7\frac{1}{2}) = (\frac{16}{25}$ of $\frac{15}{2}) =$ ($\frac{8}{5}$ of $\frac{3}{1}$) = $\frac{24}{5} = 4\frac{4}{5}$ per cent. Ans. Hence, the railway shares pay £⅘ or 12s. per cent. better than the bank shares.

3rd Example. A person invests £6750 in the Diddlem Gold Mining Co. Limited, in £15 shares, which the first year pays 12½ per cent., and the second year 2s. 6d. a share. He then sells out at £2 10s., and invests the *entire* proceeds in Northport Pier preference £10 shares at £14½, paying 7½ per cent. on the original issue,—find his yearly interest after transfer. I should here first explain the meaning of the term 'limited' as applied to companies—no liability can come on the shareholders beyond the full amount of each share taken up. Hence, the word 'limited' must be part of the title of the company, always appearing in whatever manner the name is exhibited, so that creditors must judge for themselves as to trusting the firm. There appears, however, in this company to be one qualification *un*limited, as in scores of its congeners, rascality in the directorate. Now for the process of working,—£6750 ÷ £15 = 450 shares. The first dividend, paid undoubtedly indirectly out of capital, will be £6750 ÷ 8 (12½ per cent. being ⅛) = £843 15s., and the second 450 times 2s. 6d. = £56 5s.; hence the two years' dividends = £900. Again, £2 10s. × 450 (shares) = £1125, the wreckage secured on selling out; then £1125 + £900 = £2025, total obtained from the Diddlem for the £6750 invested two years ago. £2025 ÷ 16 = 126⅝

number of shares purchased in the Northport Pier, and 7½ per cent. on £10=15s. the dividend per share; hence (15s. × 126$\frac{9}{16}$)=£$\frac{3}{4}$ × 2$\frac{025}{16}$=£94 18s. 5¼d. Ans.

The above must suffice for Stocks, Shares, etc., space in the PRACTICAL TEACHER becoming monthly, I am reminded, of increased value. The same remark must apply to percentages generally, as, although there are other various miscellaneous operations coming under the term percentages, there can be little difficulty in dealing with them if the principles and working of the six subdivisions (*a* to *f*) have been fairly grasped.

Having gone over the ground, which may be fairly considered as an ordinary curriculum in arithmetic, at least for elementary schools, I am happy to congratulate myself and my readers, that though this paper has been protracted to an unconscionable length—very far beyond my original intention, but which I found far easier to amplify than to curtail—the end is now distinctly 'within measurable distance.' There are, however, a few supplementary principles and processes which ought not to be entirely omitted. The first we will consider are *Proportionate Parts* and *Equation of Payments*, both really being the same in principle. Without any preliminary remarks, we will at once proceed with a few examples.

1st Example. Divide £85 among 4 boys in the ratio 1, 2, 3, 4. I should first explain clearly what the question means—that for every £ or *s.*, or whatever sum of money the first boy gets, the second is to have twice as much, the third three times as much, and the fourth four times as much. I should take 4 boys, and give to the first 1 article (say a marble), to the second 2, to the third 3, and to the fourth 4. I should now elicit that I have given 10 marbles, of which the first boy has got 1, that is, $\frac{1}{10}$ of the lot, the second $\frac{2}{10}$, or $\frac{1}{5}$ of the lot, etc. Or, in another phase of the question, that the second boy will get twice as much as the first, the third 3 times as much, and the fourth 4 times as much. Hence $\frac{1}{10}$ of £85 = £8 10s. the first boy, £8 10s. × 2 = £17 the second, £8 10s. × 3 = £25 10s. the third, and £8 10s. × 4 = £34, the fourth boy. Now show that the sum of these 4 shares is £85, and that their ratio to each other fulfils the conditions given—(say) that the third has as much as the first and second, that the fourth has twice as much as the second, etc.

2nd Example. £12,540 has to be divided between A, B, and C, so that A shall receive three-sevenths of B's and C's shares, B shall receive two-ninths of A's and C's; find the share of each. (*S.* G. Q., No. 284.) First, I would premise that it is somewhat anomalous to divide '*between*' *three* persons, but the language is not mine, but that of the Education Department, as given *verbatim et literatim* to male students in 1876. I have seen many good arithmeticians, both scholars and p. ts., puzzled with this question, they complaining that there is nothing to get hold of, every avenue being seemingly closed. A gets $\frac{3}{7}$ of B's and C's shares, and supposing B and C get £7 between them, then A will get £3, hence out of every (£3 + £7) £10 given among them, A will get £3, or $\frac{3}{10}$ of the amount. Hence $\frac{3}{10}$ of £12,540 = £3762, A's share. Again, supposing A and C to receive £9 between them, then as B gets $\frac{2}{9}$ of what they together get, he will receive $\frac{2}{9}$ of £9 = £2. Consequently, out of £11 (£9 + £2) distributed among the three, B will get £2, or $\frac{2}{11}$ of the whole, then $\frac{2}{11}$ of £12,540 = £2280, B's share. C's is easily got, the other two being obtained, £12,540 − (£3762 + 2280) = £6498, C's share. Ans. In class teaching every step of the above should be recapitulated two or three times.

3rd Example. Apportion £932 1s. 10½d. among A, B, and C, so that A's share may be to B's as 1 : 1½, and B's to C's as 1 : 1¼. (*Mansford*, No. 8 in Ex. 68.) A's share is to B's as 1 to 1½, that is, as 2 to 3; and B's is to C's as 1 to 1¼, that is, for every (say) £2 A gets, B gets £3, and as C gets 1¼ to B 1, that is, 1¼ times as much as B gets, then for every £3 B gets, C will get £3 × 1¼ = £3¾. Hence their respective ratio is 2, 3, 3¾, that is, clearing of the fraction, 8, 12, 15; and as the total of these is 35, then A will get $\frac{8}{35}$ of £932 1s. 10½d. = £213 1s.; B 1½ times as much = £319 11s. 6d.; and C gets 1¼ times B's = £399 9s. 4½d. Ans. Or, as an alternative method, having got the sum of the ratios = 35, then $\frac{1}{35}$ of £932 1s. 10½d. = £26 12s. 7½d., which, multiplied respectively by 8, 12, and 15, will give the three shares as above. The most difficult point is getting C's share in ratio with the *two* others, which should be well explained.

4th Example. A, B, and C are sent to empty a cistern by means of two pumps of the same bore. A and B go to work first, making 37 and 40 strokes respectively a minute; but after 5 minutes they make each 5 strokes less a minute, and after 10 minutes more A gives way to C, who works at the rate of 30 strokes a minute. The cistern is emptied in 22 minutes altogether, and the men are paid 12s. 7d. for their labour. What should each receive? (*Colenso*, No. 19, Ex. 68.) As both the pumps are of the same bore, and all the strokes are supposed to be equally effective, each man must be paid according to what ratio his strokes bear to those of his two colleagues. We will first find the number of strokes given by each.

A's are	(37 × 5) + (32 × 10)	= 505
B's ,,	(40 × 5) + (35 × 17)	= 795
C's ,,	30 × 7	= 210
	Total strokes given ...	1510

Again, 12s. 7d. = 151d., hence it is obvious that $\frac{1}{10}$d. is paid for each stroke; then A receives 505-tenths of a penny = 50½d. = 4s. 2½d., B 795 = 79½d. = 6s. 7½d., and C 210 = 21d. = 1s. 9d. Ans. To a class I should read the question again carefully, and reconsider each step taken.

We will next consider briefly the doctrine of *Averages*, as it occupies such a prominent position in all statistics, of whatever kind, and is becoming increasingly important in the educational world. Before I attempt a definition of 'average,' I cannot resist the temptation to relate an incident that came under my own observation some fifteen years ago. In a reading lesson in the second standard, which I was teaching, the word 'average' occurred, and asking what it meant, a boy promptly replied, 'What hens lay on.' Thinking I had misunderstood him, I asked him again, when he unhesitatingly gave me the same reply. On further inquiry, I found he had got his idea from a question in my 'Exercises on Arithmetic,' No. 219, simple multiplication and division, old series, which reads as follows:—'If hens, on an average, lay 4 eggs a week, how many eggs will 720 hens lay in 5 years of 52 weeks each?' This taught me a lesson on the importance of children in the lower standards even

having some correct notion of the meaning of the words they read.

Average may be defined as an equalization, real or imaginary, of a series of different numbers. Supposing one boy has 2 marbles and another 4, if they were equalized, each would get 3. Again, three boys have respectively 11, 17, and 29 marbles; find the average. Here the total is 57, which, equally divided among the 3 boys, gives 19 each. We will work out two questions from *Colenso*:—

1st Question. At a competitive examination there were four candidates at the age of 19, 3 at 20, 2 at 21, and 3 at 23; find the average age. We will first find the aggregate age of the whole 12 candidates—$19\times4=76$, $20\times3=60$, $21\times2=42$, $23\times3=69$, giving a total of 247 years. Then $247\div12=20\frac{7}{12}$ years. Ans. The process is easily understood, requiring little explanation. This, as an *absolute* result, is, however, more or less fallacious, as it is assuming—what is exceedingly improbable—that their respective ages were *exactly* 19, 20, etc., not a month or even a day over the completed year. Of course, the average age would really be more if the supplementary months or days were reckoned, but as a *relative* comparison between different batches of candidates, it would answer the purpose.

2nd Question. The average of twenty-one results is 61, that of the first eight being 64, and of the next eleven 59. Required the average of the last two. First, $64\times8=512$, the total of the first eight, and $59\times11=649$, the total of the next eleven; then, $512+649=1161$, the total of the first nineteen, but $61\times21=1281$, the total of the whole twenty-one; hence, $1281-1161=120$, the total of the last two, and $120\div2=60$. Ans. From the working of the above examples we deduce the general rule—divide the aggregate of the series given by the number contained in the series.

With the above, I bring my remarks on 'How I Teach Arithmetic' to a close, leaving Involution, Evolution, Duodecimals, etc., as belonging more to the domain of Mensuration. The principle of the two former resting on a knowledge of algebra, and being taught as arithmetic only by rule, which can be found in any treatise on arithmetic, it is unnecessary to go into the subject. Trusting that this lengthy article may have contributed in some slight degree to make the teaching of arithmetic more intelligent and more intelligible, I now bid my patient readers farewell.

(Concluded.)

The Amended Syllabus of the New Class Subject.—Elementary Science.

BY RICHARD BALCHIN.

THE syllabus of this subject as it now appears in the Code differs very considerably from that presented in the famous 'Proposals.' It was advocated in the columns of this magazine that the teacher be allowed, to a large extent, to draw up his own scheme and submit it for approval to H. M. Inspector. This point has been conceded. The word 'quadruped,' as a term of classification which appeared in the syllabus of the 'Proposals,' and which the PRACTICAL TEACHER also pointed out as being unscientific, has been struck out. Now, the reader of the Code will find that for all practical purposes, no scheme at all is presented. For no one will pretend to say that the list of items now given will furnish even the barest outline of a syllabus; so it may be ignored. The teacher is in fact thrown entirely upon his own resources. Left at perfect liberty to work out his own conception of what it is to teach elementary science. He need think of nothing in the way of limitation, except perhaps the sentence which heads the subject; viz:—'A progressive course of simple lessons, adapted to cultivate habits of exact observation, statement, and reasoning.' This sentence contains a very excellent generalization of the whole purpose of science teaching. 'Exact Observation'; 'Exact Statement'; 'Exact Reasoning.' It is as if Mr. Mundella had said to us teachers:—'Gentlemen, I do not so much care about the particular items of science that you each may decide to take. That may be regulated by the bent of your own individual minds, and by what you conceive to be to the interest of the boys in your own particular localities. What I am most anxious about is that whatever you determine to teach, shall tend to develope in the child the power to observe exactly, to state in words clearly, and to think accurately; but, inasmuch as I am responsible for the proper administration of public funds granted for these educational purposes, I must ask you each to draw up a syllabus, so that our examiners shall know what it is you profess to have done, in order that a test may be applied, to discover whether or no, that particular thing is obtained for which the public pay.' Personally I think the Proposals and the Code constitute an immense step in advance. They combine these two points as effectually as it is possible to combine them; viz:—Liberty to the teacher for the play of his own individuality, and a guarantee on the part of the Department that the purpose for which the education grant is given, is really secured. It will be less possible in future for a teacher to work exclusively for the examinations. Let me for a minute explain what I mean by 'working for the examinations.' Arithmetic occupies the same place in our primary schools as mathematics and logic do in the Universities. The purpose of Arithmetic is to develope certain mental powers. Now the examination teacher cares nothing about 'the development of certain mental powers.' He only thinks of getting his boys to pass. But in future, before the Inspector assesses the 'Special Merit Grant' he will have to inquire carefully whether Arithmetic has been intelligently taught, and such sham educators as examination teachers will be discovered.

With respect to the practicability of taking up this new class subject, I have decided to work upon the following plan:—Standards I. to IV. inclusive form Division I.; Standards V. to VII.

form Division II. In Division I. I shall take, as class subjects, grammar and elementary science. In Division II. grammar and geography. The special subjects in Division II. will be mechanics and botany. The reasons for adopting this plan are: That science will be taught throughout the school, viz., as a class subject in Division I. and as specifics in Division II. I do not take elementary science as a class subject in Division II., because its syllabus would necessarily include many of the items coming under the head 'Mechanics,' and I do not think that the Department would be found willing to pay twice over for the same thing. We introduce geography as a class subject in Division II., else the boys would leave school without having acquired any geographical knowledge whatever. A very good groundwork for the specific subjects can be laid out in the syllabus for the class subject, 'Elementary Science' in Division I.; the boys would then be well prepared to take mechanics and botany when they pass into the upper division. The following is a scheme of science teaching that I have prepared for adoption at Gloucester Road:—

Standard I.—To tell from pictures the names of these animals: ape, kangaroo, ostrich, crocodile, frog, salmon, butterfly, caterpillar, and oyster, with short stories and interesting particulars. Also from pictures or specimens to tell the names of these trees: oak, elm, beech, fir, plane, sycamore, chestnut, and lime.

Standard II.—The general division of animals into backboned animals, and animals without a backbone. The parts of a plant, root, stem, leaves, blossom, fruit; uses of those parts to man and to the plant. Solids, liquids, and gases. Lessons on chalk, coal, iron, cotton, and flax.

Standard III.—The backbone, and the division of vertebrate animals into mammals, birds, reptiles, amphibians, and fish. The parts of a blossom, functions of those parts. Some properties of matter, *i.e.*, elasticity, flexability, friability, expansibility, and compressibility. The stones in the streets (1), flagstones, can be powdered up to sand (sandstones), kerbstones, can be powdered up into different coloured grains (granite). The stones round the windows can be burnt to lime (limestone).

Standard IV.—The heart and breathing organs of a fish, a frog, a crocodile, a bird, and a mammal. Formation of fruits. The mechanical powers, lever, pulley, wheel, and axle, and inclined plane. Thermometer and barometer. The chemistry of air and water, chalk, and the burning of a candle.

It must be borne in mind that I assume the examination by the inspector to be oral only. A written examination would entirely frustrate the aim sought by this science teaching.

——o——

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

(1) From seven thousand four hundred and sixty-three, take two thousand six hundred and forty-eight. Ans. 4815.

(2) From six thousand seven hundred and four, take eight hundred and sixty-two. Ans. 5842.

(3) Add together three hundred and seventy-six, nineteen, four hundred and thirty-five, seven hundred and thirty, and four hundred and six. Ans. 1966.

STANDARD II.

(1) From forty thousand and ninety-six, take twenty-four thousand three hundred and ninety-eight. Ans. 15,698.

(2) Multiply fifty-eight thousand four hundred and sixty-nine, by five hundred and eighty-four. Ans. 34,145,896.

(3) Divide sixty-one thousand three hundred and seven, by nine. Ans. 6811 – 8.

STANDARD III.

(1) A father, mother, and two sons, earn altogether £4 per week. The mother earns 6s. 8d., and each of the two sons 18s. a week. What does the father earn a week. Ans. £1 17s. 4d.

(2) From six hundred and three thousand five hundred and eight pounds fourteen shillings and three pence halfpenny, take fifty seven thousand and twenty-nine pounds sixteen shillings and ninepence farthing. Ans. £546,478 17s. 6¼d.

(3) Add together seventy pounds sixteen shillings and one halfpenny, one thousand and eighty-five pounds eight shillings and four pence, three hundred and sixty-eight pounds seventeen shillings and sixpence halfpenny, ninety thousand four hundred and eighty pounds and tenpence farthing, and five pounds eleven shillings and sevenpence three farthings. Ans. £91,938 14s. 5d.

(4) Divide 833,032 by 146. Ans. 5705—102.

STANDARD IV.

(1) I gave five five-pound notes in payment of 37 yards of silk, and received £1 13s. 7¾d. change. What was the price per yard? Ans. 12s. 7¼d.

(2) Reduce 39,024 sq. in. to sq. yds. Ans. 30 yds. 1 ft.

(3) Multiply £743 18s. 9½d. by 395. Ans. £293,856 2s. 8½d.

(4) Divide £18,013 2s. 8½d. by 76. Ans. £237 0s. 3½d.—26.

STANDARD V.

(1) If 3 cwt. 1 qr. of sugar cost £1 12s. 1d. What is the value of 10 tons 10 cwt.? Ans. £103 13s. $0\frac{4}{13}$d.

(2) 55 miles 7 fur. 38 pls. at £4 13s. 4d. per mile. Ans. £261 6s. 1d.
(3) 9605 @ £7 18s. 5½d. Ans. £76,099 12s. 3½d.
(4) 13 tables at 14s. 10d. each.
54 chairs at £2 14s. per dozen.
30 sq. yds. of cloth at 2s. 3d. per sq. yd.
3 men's wages for 3 days, @ 4s. 3d. per day each. Ans. £27 1s. 7d.

STANDARD VI.

(1) I sold 3 cwt. 2 qrs. 19 lbs. of old lead for £5 19s. 10½d. What price per cwt. did I receive for it? Ans. £1 12s. 8d.
(2) If 25 men can reap a field of 85 acres in 12 days, how many men will reap 51 acres in 10 days? Ans. 18 men.
(3) From $\frac{1}{3}\frac{7}{5}$ of 10 cwt. a grocer sold $5\frac{5}{14}$ of 3 qrs., how many lbs. had he left? Ans. 94 lbs.
(4) From $\frac{3}{7}$ of $10\frac{1}{2}$ take $\frac{8}{1\,7}$ and divide the answer by $2\frac{4}{9}$. Ans. $1\frac{485}{748}$
(5) Divide 48,224 by 13·7, also divide 13·7 by 48224. Ans. 3520 and ·00028409.

Botany.

Name as many different kinds of roots as you can, and give examples of each.
What is an adventitious root, and how do you distinguish it from a creeping stem?
Name the flower-leaves of a common buttercup.
How does the flower of a primrose differ from that of a buttercup?
Describe the leaves and stem of a wallflower.

Physiology.

What is meant by the skeleton? What are its uses? Name the bones which form the Pelvis.
Explain how the elbow-joint is worked.
Where are the stomach, the heart, the kidneys, and the pancreas situated?
Describe what evils arise from 'tight lacing.'
What is the alimentary canal?
What are the uses of nerves?
What are arteries and veins? How do they differ?

Dictation.

STANDARDS V. AND VI.

There is a beautiful propriety in the order in which singing birds fill up the day with their pleasing harmony. The accordance between their songs and the aspect of nature, at the successive periods of the day at which they sing, is so remarkable, that one cannot but suppose it to be the result of benevolent design. First the robin (not the lark, as has been generally imagined), as soon as the twilight has drawn his imperceptible line between night and day, begins his artless song.

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,
Joint Author of 'The Field Naturalist's Handbook.'

No. XII.—THE LEPIDOPTERA. PART II.

PASSING by several families of moths, we come to the Tiger Moth, an insect more commonly seen in its larval than in its perfect state. It is hardly possible to walk along a country lane in the spring without noticing a colony or two of these caterpillars feeding upon the nettles and other plants growing by the roadside. These larvæ are popularly known as 'Woolly Bears,' owing to the quantity of long hair with which their bodies are thickly covered.

The perfect insect, although very plentiful, is comparatively seldom seen, owing to its retiring habits. It cannot, however, resist the mysterious attraction which artificial light appears to exercise towards many insects, and may often be noticed upon a dark night fluttering wildly around the street lamps, or resting peacefully upon the panes which enclose the source of attraction. It is a very handsome insect, the upper wings being of a rich velvety-brown, intersected with white markings, while the lower pair are generally red, variegated with large blue-black blotches of variable number, size, and form. It would be impossible, however, to write a description which would apply to all specimens of the moth, as the colour and markings vary to a most wonderful extent. Sometimes a tiger moth will be found in which all four wings are of an uniform brown-black hue, scarcely a trace of the ordinary markings being visible. In other cases a creamy white predominates to an almost equal degree, while in less aberrant specimens the form and size of the usual markings vary to an almost inconceivable degree. It would, indeed, be by no means a difficult task to fill a case with a number of examples of this moth, no two of which should exactly resemble one another.

Allied to the tiger moth, although placed in a different family, the Gold-tail Moth next claims our attention. This is a singularly pretty insect, the wings, head, thorax, and the greater part of the body being of a pure satiny-white. The extremity of the abdomen is adorned with a large tuft of golden-yellow hair, from which the insect derives its popular name.

The chief interest of the gold-tail moth centres in the caterpillar, whose body is thickly covered with hairs endowed with a peculiarly poisonous property. If the creature be handled, a number of these hairs are sure to enter the skin, and will leave unpleasant reminiscences of their presence for some little time. At first an intolerable itching is felt in those parts which have been pierced by the poison-bearing hairs. This is speedily followed by the swelling of the affected parts, which sometimes takes place to such an extent that the victim appears as if a number of large potatoes had been introduced beneath his skin.

Some persons are far more severely affected by these 'urticating' hairs, as they are scientifically termed, than others, while a favoured few are entirely unharmed by them. They are not peculiar to the gold-tail larva, for the caterpillars of many other allied insects are similarly endowed, although in a lesser degree.

The larva is a very handsome one, the ground-colour being black, while two interrupted vermilion stripes run longitudinally for the entire length of the

body. It feeds principally upon the whitethorn. The female moth has a curious habit of covering her eggs with a kind of thatch, formed from the tuft of golden hair at the extremity of her body, which she tears off for the purpose.

In the warm, sunny days of August and September a small, brown moth may be seen dashing wildly to and fro with a curiously erratic flight, changing the direction of its course almost every other moment. Even in the smoky squares of London this active little creature may be noticed, revelling in the warm rays of the sunshine.

This is the male Vapourer Moth, really a very pretty insect, the wings being of a rich chestnut-brown, with a white crescent-shaped spot in the anal angle. No one except an entomologist, however, would recognise the female vapourer for a moth at all, for she is a clumsy, grub-like creature, almost entirely destitute of wings, and bearing no resemblance whatever to her active and handsome mate. So large and ungainly is her body in proportion to the size of her limbs that she is quite unable to move a single step, and spends the whole of her existence clinging to the web which contained the pupa from which she emerged. Upon this web she lays her eggs, arranging them in long rows with great regularity, and dying as soon as her task is completed.

It is a curious fact that the eggs of the vapourer moth do not hatch simultaneously, as is the case with those of insects in general, but do so in detachments, a period of eight or ten weeks elapsing between the time in which the first larva makes its appearance and that in which the last of the brood leaves the egg-shell. It is, therefore, by no means unusual to find the insect in all the stages of its development at the same time, a single tree furnishing egg, larva, and pupa, while the perfect insect may be seen fluttering in the neighbourhood.

This is also the case with an allied species, the Oak-eggar Moth, and I have upon more than one occasion had the insect in all its stages in my breeding-cages at one and the same time.

The vapourer moth is a most ubiquitous creature, the larva feeding upon the foliage of almost any tree, or shrub with equal avidity. Fruit trees often suffer greatly from its attacks, and were it not for the labours of the various insect-eating birds, we should probably have to rank the insect among the greatest foes to our kitchen-gardens and orchards.

The Lackey Moth is chiefly worthy of notice on account of the manner in which the female deposits her eggs, for she places them in the neatest possible rings round the twigs of apple-trees.

We now come to the great group of Geometers—*i.e.*, 'step-measurers'—which are so called on account of the peculiar method of walking employed by the caterpillars.

It will be remembered that, as a general rule, the larvæ of the lepidoptera are provided with ten false legs, or claspers, in addition to the six true limbs which are possessed by every insect. In the geometers, however, four only of these claspers are found, these being placed at the extremity of the body. Owing to this structure, the larvæ of these moths are obliged to proceed in a very peculiar way, and do so in the following manner :—

Clinging tightly to the twig upon which they are resting with the true legs, they draw the body into a loop, so that the anal claspers are brought into close proximity to the head and legs. A firm hold is then taken with the claspers, and the body stretched out to its full length, when a fresh hold is taken with the true legs. The body is again drawn up as before, and the process repeated as often as required. In consequence of this habit, the larvæ are often called 'Loopers.'

Nearly all the geometer larvæ are protected from the attacks of birds and other enemies by the wonderful resemblance which they bear to the twigs of the food-plant. Many of them have projections upon various parts of the body which are so wonderfully similar in appearance to the young buds that even the most practised eye will often fail to distinguish the larva from the twig upon which it is resting. The attitude assumed in repose aids them greatly in their resemblance to surrounding objects, as the body is almost invariably stretched straight out at an angle from the branch to which the caterpillar is clinging, the claspers alone sustaining the entire weight of the body.

In order to do this, the muscular power must be simply marvellous. One of the most trying feats in gymnastic exercises is to hold the body at right angles to a perpendicular bar by the grasp of the hands alone, and not even the most powerful and accomplished performer can remain in that position for more than a few seconds. Yet, with these caterpillars, this apparently strained and unnatural position seems to be the normal attitude of repose, and can be sustained for hours without the slightest inconvenience.

The geometers comprise a very large number of insects, even in this country, very few of which, however, can be mentioned in this article.

One of these is the very plentiful Gooseberry, Currant, or Magpie Moth, the larva of which often appears in such numbers as to cause very considerable damage to the fruit bushes. This destructive caterpillar may be easily recognised by the cream-coloured body, and the longitudinal reddish-orange stripe running below the spiracles. It is a curious fact that neither toads nor insect-eating birds will touch this caterpillar, which seems to be protected by some flavour which is distasteful to its natural enemies.

Like the tiger moth, the magpie moth is extremely subject to variation in colour and marking, scarcely two specimens being precisely similar. The ground-colour of the wings is generally a creamy white, while a number of black blotches of uncertain size and form are distributed over their surface. There is generally a bent transverse band of yellow beyond the middle of the fore-wings, their bases being also adorned with a yellow blotch. Sometimes, however, specimens will be found in which the black markings usurp almost the whole of the wings, while in other examples their position is only faintly indicated, white being the predominant hue.

A far more destructive insect now claims our attention, fruit trees of various kinds suffering greatly from its ravages. This is the Winter Moth (*Cheimatobia brumata*), which, unlike insects in general, makes its appearance upon the wing at a time when insect life is conspicuous by its absence.

Upon any mild evening in December or January, we may see a number of delicate, light-brown moths fluttering round every lamp-post, in their vain attempts

to discover the mystery of the flame. These are the male winter moths, the female being possessed of only the merest rudiments of wings. In general form, indeed, she is not unlike a spider, and is able to run about the tree-trunks with considerable activity.

Her eggs are deposited in the crevices of the bark of various fruit trees, such as the apple, pear, plum, quince, etc., the young larvæ hatching in early spring, and at once making their way into the, as yet, unopened buds. At this period of their existence vast numbers are destroyed by titmice and other small birds, which, however, according to the late Mr. E. Newman, do not appear to discriminate with sufficient care between the sound and the damaged buds. When the leaves are a little more advanced, the grubs emerge from their domiciles, and spin two or three together, in order to form a refuge in which they are concealed from the sight of their numerous foes, and which they only partially leave when engaged in feeding. In May they are full-fed, and then descend to the ground in order to undergo their change to the pupal condition.

In order to rid the orchards as far as possible of the pest, Mr. Newman recommends that each tree should be painted with a mixture of Stockholm tar and cart-grease, laid on in a circular belt. This composition does not injure the tree, and captures the female moths in great numbers as they ascend the trunks in order to deposit their eggs. The application must be renewed once in four or five days or so, and also after a frosty night, which causes it to harden, and so renders it useless.

An inspection of the trees after dark by the aid of a lantern is also recommended, in order that any moths which had taken up their abode in the branches before the sticky mixture was applied might be detected and killed before they had an opportunity of depositing their eggs.

Yet, even if every precaution be taken, more or less damage is sure to be caused in every orchard by this destructive moth, which we must certainly rank as one of the most mischievous of our insect foes.

Omitting, from lack of space, the next group of moths, we come to the large division of the *Noctuæ*, or Owl Moths, so called because they fly almost exclusively by night. Of these, more than three hundred species inhabit Great Britain, while the group is very largely represented in other parts of the world.

One of the earlier species of these, the Peach-blossom, must be mentioned merely for the sake of its marvellous beauty, each of the upper wings being adorned with five pink spots of the exact form and hue of the petals of the peach. The ground-colour is a rich olive-brown. A prettier insect could hardly be imagined, and, as far as the British *noctuæ* are concerned, the peach-blossom certainly bears away the palm in point of beauty. In some places it is fairly plentiful, while in others it is seldom or never seen.

To this group belong also the destructive Turnip Moth (*Agrotis segetum*), and the equally mischievous Cabbage Moth (*Mamestra brassicæ*), both of which are among the direst foes of the agriculturist. The former is perhaps the more to be dreaded of the two, as the ravages of the larva take place beneath the ground, where its presence is not easily to be detected. It does not hibernate, or pass the winter in a state of torpid inaction, but continues to feed as before.

But very few of the *noctuæ* are of interest to any but professed entomologists, their habits and mode of life being very obscure, and only a very small proportion exercising any influence, direct or indirect, upon man himself. An exception to the general rule, however, is the Silver Y Moth (*Plusia gamma*), which scarcely any resident in the country can have failed to notice. It is almost unique among the lepidoptera in its habit of flying both by day and night, sporting round various flowers in the sunshine, and visiting the street-lamps after darkness sets in.

In the summer of 1879 a vast immigration of this insect took place in this country as well as in other parts of Europe. The moth was everywhere to be seen in countless numbers, flying up in thousands in every direction as one passed along, and sometimes almost bewildering one by its wonderful abundance. In other parts of Europe the insect was found in the same extraordinary plenty, and the swarm seems even to have extended to certain districts upon the African continent.

The name 'Silver Y' has been applied to this moth on account of the peculiar silver mark upon the fore-wings which closely resembles the English letter Y, or the Greek letter gamma (γ). Another moth of the same genus, the Golden Y (*P. iota*), has a mark of similar form, but of a golden instead of a silver hue. The whole genus is remarkable for the bright metallic patches which are found upon the wings of all the members, but which vary very greatly in form and colour in the different species.

The last *noctua* which we can mention is the handsome Red Underwing, a plentiful insect in the southern counties of England. When at rest, it is a comparatively commonplace insect in appearance, the markings of the upper wings being merely composed of a rather curious admixture of several shades of grey and brown. When the wings are spread, however, the full beauty of the moth is disclosed, the bright red under-wings affording a rich contrast to the grey and brown of the upper pair.

Except in flight, however, these wings are never shown, and the upper wings harmonize so exactly with the hues of the tree trunks upon which the insect generally rests, that it is perfectly invisible to any but the most practised eye. The moth is rather a large one, being rather more than three inches in spread of wing.

Next come a large number of moths, comprised in several families, which are collectively known as '*Micro-Lepidoptera*,' on account of the small size of most of the members. With the exception, perhaps, of the Clothes Moth, which is only too familiar an insect to most of us, very few of these moths possess any general interest, and there is none amongst them which need be especially singled out for description. We will therefore bid adieu to the lepidoptera, and proceed, in the following paper, to the next order of insects, namely, the *Homoptera*.

(To be continued.)

ANSWERS TO

Pupil Teacher's Examination Paper.

MARCH 25TH, 1882.

CANDIDATES.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. Find, by Practice, the cost of 5 bins of oats, each containing 7 quarters, 7 bushels, 3 pecks, at £1 8s. 8d. per quarter.

7 qrs. 7 bu. 3 pks. × 5 = 39 qrs. 6 bu. 3 pks.

		£	s.	d.
Value of 1 qr.	=	1	8	8
				39
,, 39 qrs.	=	55	18	0
,, 4 bu. = ½ val. of 1 qr.	=		14	4
,, 2 bu. = ¼ ,, 4 bu.	=		7	2
,, 2 pks. = ¼ ,, 2 bu.	=		1	9½
,, 1 pk. = ½ ,, 2 pks.	=			10½
,, of the 5 bins	=	57	2	2½ Ans.

2. A bankrupt pays up £2,284 4s. 9½d., being at the rate of 12s. 10½d. in the £ of his debts. What was the amount of his debts?

12s. 10½d. : £2,284 4s. 9½d. :: £1 : amt. of debts.
or or
309 halfd. : 1096435 halfd.

$$\frac{£1 \times 1096435}{309} = £3548\ 6s.\ 8d.\ \text{Ans.}$$

3. If 48 lbs. of wool make 230 yds. of cloth, 1 yard wide, how much cloth, 1¼ yds. wide, ought 36 oz. to make?

48 lbs. : 2¼ lbs.
1¼ yds. : 1 yd. } :: 230 yds. : length required.

$$\frac{230 \text{ yds.} \times 9 \times 4}{192 \times 5} = \frac{69}{8} = 8 \text{ yds. } 2 \text{ qrs. } 2 \text{ nls. Ans.}$$

4. A parish, containing 960 acres, is rated on a rental of £2,040; a rate of 8d. in the £ is levied. What, on the average, is the charge per acre?

8d. = $\frac{1}{30}$ of £1 ∴ the rate on the whole = $\frac{1}{30}$ of £2,040 = £68.
£68 ÷ 960 = $\frac{1360}{960}$s. = 1s. 5d. charge per acre. Ans.

FEMALES.

1. Make out the following bill:—

27½ lbs. Hyson tea at 5s. 11½d. per lb.
46⅔ lbs. Bohea tea at 3s. 11d. per lb.
25⅓ lbs. Mocha coffee at 2s. 2d. per lb.
17⅞ lbs. Demerara coffee at 1s. 4d. per lb.
105⅓ lbs. sugar at 6¾d. per lb.
256 lbs. rice at 2¼d. per lb.
18¾ lbs. ham at 8d. per lb.
59$\frac{19}{24}$ lbs. ham at 6½d. per lb.

	s.	d.		£	s.	d.
27½ lbs. at	5	11½	per lb. =	8	3	10½
46⅔ ,,	3	11	,, =	9	3	1½
25⅓ ,,	2	2	,, =	2	14	5½
17⅞ ,,	1	4	,, =	1	3	6
105⅓ ,,	0	6¾	,, =	2	19	3
256 ,,	0	2¼	,, =	2	8	0
18¾ ,,	0	8	,, =	0	12	6
59$\frac{19}{24}$,,	0	6½	,, =	1	12	4½
				£28	17	0½ Ans.

2. Find the value of 46,584 articles at £8 17s. 3½d. each.

	£	s.	d.
(*a*) Value of 46,584 at £9 each =	419,256	0	0
(*b*) Deduct value of 46,584 at 2s. 8¾d. each.			
Value of whole at £1 =	46,584	0	0
,, at 1s. 8d. = $\frac{1}{12}$ at £1 =	3,882	0	0
,, at 1s. 0d. = $\frac{1}{20}$,, =	2,329	4	0
,, at 0s. ¾d. = $\frac{1}{16}$ at 1s. =	145	11	6
=	6,356	15	6
∴ 46,584 at £8 17s. 3½d. =	412,899	4	6

3. What is the cost of 374 qrs. 7 bus. 2 pks. of wheat at £2 3s. 8d. per quarter?

		£	s.	d.
Value of 1 qr.	=	2	3	8
				374
,, 374 qrs.	=	816	11	4
,, 4 bus. = ½ val. of 1 qr.	=	1	1	10
,, 2 ,, = ½ ,, 4 bus.	=	0	10	11
,, 1 ,, = ½ ,, 2 ,,	=	0	5	5½
,, 2 pks. = ½ ,, 1 ,,	=	0	2	8¾
,, of 374 bus., etc.	=	818	12	3½ Ans.

4. The driving wheel of a locomotive engine is 15½ feet in circumference; how many times will it revolve between Edinburgh and Glasgow, the distance being 46½ miles?

15½ ft. = 46 thirds of a foot.
46½ miles = 5,280 ft. × 46½ = 245,520 ft. = 736,560 thirds of a ft.
736,560 ÷ 46 = 16,012$\frac{4}{23}$ times.

Grammar.

1. 'Full oft the rescued boy she kissed,
And often pressed him to her breast;
For under all her dauntless show,
Her heart had throbbed at every blow;
Yet not Lord Cranstoun deigned she greet,
Though low he kneelèd at her feet.'—SCOTT.

Parse all the verbs and adverbs in the above.

full—adv. of deg., mod. *oft.*
oft—adv. of time, mod. *kissed.*
kissed—trans. verb, reg., indic., past indef., 3rd pers. sing., agr. with *she.*
often—adv. of time, mod. *pressed.*
pressed—trans. verb, reg., indic., past indef., 3rd pers. sing., agr. with (*she*).
had—past indef., indic. of auxiliary verb *have, had, had,* forming with the complete part. of the reg. intrans. verb. *throb.*
had throbbed—past perf. indic., 3rd pers. sing., agr. with *heart.*
not—adv. of negation, mod. *deigned.*
deigned—intrans. verb, reg., indic., past indef. 3rd pers. sing., agr. with *she.*
(*to*) *greet*—trans. verb., reg, infin. pres., indef. gov. by *deigned.*
low—adv., mod. *kneeled.*
kneeled—intrans. verb, reg, indic., past indef, 3rd pers. sing., agr. with *he.*

2. Compound verbs are sometimes made up of the auxiliary and the participle, sometimes of the auxiliary and the infinitive mood. Give example of each kind.

In the compound verb the auxiliaries *have* and *be* are followed by the *participle:* as 'I have gone,' 'it had throbbed,' 'he was pressed.'

The auxiliaries *shall* and *will* are followed by the *infinitive:* as 'I shall (to) go,' 'they will (to) run,' 'she should (to) have gone.'

3. How are adverbs compared for the most part? Give examples of some adverbs that are exceptions to the common rule in this respect.

Adverbs are for the most compared by means of the adverbs *more* and *most:* as *nobly, more nobly, most nobly.* They are also compared by adding 'er' and 'est': as *often, oftener, oftenest.* The following are exceptions to the foregoing rules:—*well, better, best; bad'y, worse, worst; near, nearer, next; far, farther, farthest; much, more, most.*

Geography.

Answer two Questions.

1. Describe a coasting voyage from Southampton to Bristol.

If you can, draw a map of this portion of the coast.

Sailing from *Southampton,* a great packet station, we skirt the coast of the *Isle of Wight,* which has been called the garden of England, navigate the channel called the *Solent,* and observe the *Needles,* the western termination of the Isle of Wight. The coast now curves round to *Poole Harbour,* south of which is the *Isle o Purbeck,* with its limestone known as Purbeck marble.

After passing *St. Alban's Head* we reach Portland Bill, with excellent building stone, and as we describe the curve round to *Start Point*, we meet with *Lyme Regis*, *Torbay*, *Torquay*, *Dartmouth*, and reach *Plymouth*, noted for its gigantic breakwater, with Eddystone Lighthouse to the south. As we continue towards *Lizard Point* we note *Falmouth*, a packet station, and *Mount Bay*, so named from St. Michael's Mount, situated in it. *Penzance*, noted for its mild climate, lies near *Land's End*. Proceeding north-east, we round *Hartland Point* into *Bideford Bay*, with *Lundy Isle* on our left. Continuing easterly we reach our destination, *Bristol*, the fourth seaport of England.

2. The subject for a prize theme at a school was:—

"*What county of the British Islands contains the most beautiful scenery? Give a description of it.*" Four boys tried for the prize, one born in Cumberland, one in Carnarvonshire, one in Perthshire, and one in Kerry; and each chose his own county. What did each find to say?

Cumberland is composed of three distinct parts: the south-western half is very mountainous, containing the greater portion of the Cumbrian hills; the north-eastern part is formed of the slopes of the Pennine moorlands; and between the two lies a broad and fertile plain, the lower valley of the Eden. This county contains the highest mountains in England, and most of the English lakes, which are the more remarkable as being the only large sheets of water throughout the whole country, and give to this region the name of the *Lake District*. These lakes lie in a somewhat regular order, occupying long narrow valleys, which are ranged round the centre of the group, Helvellyn, and radiate from it outwards like the spokes of a wheel. In the midst of the lakes, a little to the west of Helvellyn, lies the high central valley of Borrowdale, shut in on every side by closely encircling hills, and very famous for the beauty of its scenery. The industries of the county are limited to sheep-farming, and the working of one or two lead mines; but the character of the rocks, soil, and climate, which have limited its means of wealth, have at the same time given to it a beauty in which it surpasses all other parts of England.

Carnarvonshire consists exactly of the rugged mass of the Snowdon range, and the sharp spur of rocks which run southward from it to the sea. The mountain masses which constitute the county form a bleak and inhospitable region. The wild and rugged scenery of this district, however, surpasses in grandeur any other mountain scenery south of the Tweed. The chief resources of the county lie in the rocks of which its mountains are composed. The central mountain of the range is Snowdon, whose five peaks of nearly equal height rise 3,590 feet above the sea level, and from their position and elevation determine the river system of the surrounding district. To the north the lower spurs of the mountain form the Pass of Llanberis, beyond which lies a group of heights almost as lofty as Snowdon itself, and all these summits are higher than any in England.

Perthshire is about equally divided between the mountains and the plain, forming a vast irregular circle almost exactly coinciding with the basin of the Tay. Occupying a most important geographical position, it is the only Highland county which lies wholly inland, and includes not only the bulk of the rich fields of Strathmore, but also every one of the main passes that lead from the Lowland plain into the centre of the Highlands. The mountainous districts of Perthshire consist of a series of ridges which are marked by great masses of mountains, ranging from 3,000 ft. to 4,000 ft. in height. The southern heights are not so high, but are well known for the famous gorge of the Trossachs, formed by spurs at the approach to Loch Katrine from the Lowland plain. Among these mountain ridges are enclosed the greater number of the vast circle of Highland lakes. The whole of this district, in fact, with its massive mountains, its lakes, its torrents, and its rocky glens, forms a scenery whose picturesqueness is unrivalled in Britain. A few hamlets and villages lie here and there in the river valleys, and are well known for the grandeur of the surrounding scenery. Such are Blair Athol and Pitlochrie, which, at either extremity of the Pass of Killiecrankie, command the road to northern Scotland, through the mountains up the valley of the Garry.

Kerry, bordered by the Atlantic, is deeply indented by bays, between which lie peninsulas, forming the western extremities of that mountain system which crosses the entire south of Ireland. The mountain knot, called Macgillicuddy's Reeks, contains Carntual 3,410 ft., the highest summit in Ireland. Mountain ridges, bounding valleys, of greater or less width, form the distinguishing features over the greater part of Kerry. The scenery of Kerry most attractive to tourists lies round the Lakes of ney, which merit a full description. The Upper Lake, a beautiful sheet of water, is enclosed on all sides by mountains, except at its eastern point, where it discharges its waters by a tortuous course of three miles. A channel leading from the upper to the lower lake passes through a thickly-wooded defile, and about midway between the extremities of this channel, a remarkable detached rock, called the Eagle's Nest, rises 1,100 feet high. Emerging from this defile the river expands into the Lower Lake of Killarney, bounded on its western side by mountains covered with rich natural woods. from a height of several hundred feet down to the water's edge, through a continuous distance of six miles. O'Sullivan's River forms a cascade 70 feet high, close to the shore of the lake. The opposite side is everywhere broken by promontories and islands, and the town of Killarney is situated on the plain, about a mile from the eastern shore. It presents a very animated appearance in summer, from the influx of visitors to the Lakes.

Composition.

Write from dictation the passage given out by the Inspector.

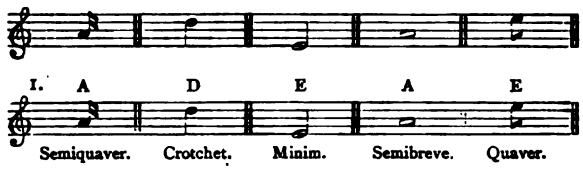
Penmanship.

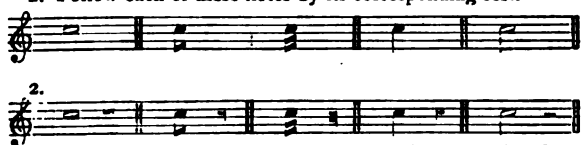
Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy*.

Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).

2. Follow each of these notes by its corresponding rest.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a semibreve?

3. If we make one beat while we sing a crotchet, we shall make *four* beats while we sing a semibreve, because a semibreve is equal in duration to four crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. How many apples must be cut up in order to give to each of 19 children one third of an apple? and what would the apples cost at the rate of 1s. 9d. per doz.?

To give $\frac{1}{3}$ to each will require $19\frac{1}{3} = 6\frac{1}{3}$ apples.
$\therefore$ 7 apples are required; and at 1s. 9d. per dozen, they will cost $\frac{7}{12}$ of 1s. 9d. = 1s. $0\frac{1}{4}$d. Ans.

2. Reduce to their lowest terms $\frac{44}{175}$, $\frac{132}{561}$; and to simple fractions $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}\frac{1}{5}$, and $7\frac{1}{2}$ of $5\frac{1}{4}$ of 11.

(*a*) G. C. M. of 240 and 875 is 5 $\therefore \frac{240}{875} = \frac{48}{175}$. Ans.
(*b*) „ 425 and 646 „ 17 $\therefore \frac{132}{561} = \frac{12}{51}$. Ans.

(*c*) $\frac{1}{2}$ of $\frac{2}{7}$ of $\frac{1}{33} = \frac{1 \times 6 \times 14}{2 \times 7 \times 33} = \frac{2}{11}$ Ans.

(*d*) $7\frac{1}{2}$ of $5\frac{1}{3}$ of 11 $= \frac{15 \times 31 \times 11}{2 \times 3 \times 1} = 170\frac{1}{2}$ Ans.

3. By how much is $1\frac{3}{5}$ of 1 ton 11 lbs, greater or less than $3\frac{3}{5}$ of 11 cwt. 6 lbs.?

	cwt.	lbs.		cwt.	lbs.
(*a*) $3\frac{3}{5}$ of 11 cwt. 6 lbs. =	11	6 × $\frac{18}{5}$	=	37	$65\frac{1}{2}$
(*b*) $1\frac{3}{5}$ of 1 ton 11 lbs. =	20	11 × $\frac{18}{5}$	=	31	$29\frac{3}{5}$
∴ (*b*) is less than (*a*) by				6	$35\frac{19}{20}$ Ans.

4. Compare the values of ·785 of £1·3, and ·875 of a guinea.

(*a*) ·785 of 26$\frac{2}{3}$s. $= \frac{\cdot 785\text{s.} \times 80}{3} = 20\cdot 93\frac{1}{3}$ s.

(*b*) ·875 of 21s. $= \cdot 875\text{s.} \times 21 = 18\cdot 375$

∴ (*a*) is greater than (*b*) by $2\cdot 558\frac{1}{3}$s. = 2s. 6·7d.

FEMALES.

1. A bankrupt whose debts amount to £7586 11s. 6½d. compounds with his creditors for 13s. 7½d. per pound; how much will they lose by him?

	£	s.	d.	
Debts =	7586	11	$6\frac{1}{2}$	
Loss of 5/- per £ = ¼ of debts =	7896	12	$10\frac{1}{2}$	or $\frac{253}{32}$
,, 1/3 ,, = ⅓ of 5/- loss =	474	3	$2\frac{1}{32}$	or $\frac{2}{32}$
,, 1½d. ,, = $\frac{1}{10}$ of 1/3 loss =	47	8	$3\frac{17}{160}$	
,, 6s. 4½d. per £ =	2418	4	$5\frac{97}{160}$	

2. If £35 8s. 4d. be the price of 110 yds. 3 qrs. 2½ nls. of carpeting, what quantity of the same could be bought for 100 guineas?

£35 8s. 4d. : £105 :: 110 yds. 3 qrs. 2½ nls. : quantity required.
or or or
8500d. 25200 3549 half nls.

$\frac{3549 \text{ nls.} \times 25200}{2 \times 8500} = \frac{3549 \text{ nls.} \times 126}{85} = 5260\frac{7}{8}$ nls. =
328 yds. 3 qrs. $0\frac{7}{8}$ nls. Ans.

3. If 72 women can reap a field of 30 acres in 4 days of 12 hours each, in what time could 54 men reap 120 acres, when the days are 10 hours long, supposing 3 men to reap as much as 4 women?

4 women's = 3 men's work } not required therefore
∴ 72 ,, = 54 men ,, } in working sum.
30 acres : 120 ac. :: 48 ho. : hours required.
$\frac{48 \text{ ho.} \times 120}{30} = 192$ ho., or 19 days 2 hrs. (da = 10 ho.)

4. If a garrison of 2,800 men in 45 days at 20 ounces each per day, consumes a certain value of bread when the 4-pound loaf is at eightpence; how many men will four times the value serve for 56 days, at 16 ounces each per day, when the same loaf is at 7½d.?

56 days : 45 days
16 oz. : 20 oz.
7½d. : 8d.
1 value : 4 times value
} :: 2,800 men : No. required.

$\frac{2800 \text{ men} \times 45 \times 20 \times 16 \times 4}{56 \times 16 \times 15 \times 1} = 12{,}000$ men. Ans.

Grammar.

1. 'Whom I most hated living, thou hast made me,
With thy religious truth and modesty,
Now in his ashes honour.'—SHAKESPEARE.

(*a*) Parse the pronouns in the above.

(*b*) What is 'whom' equivalent to in the above? Compare its use with the way in which the word 'what' is often used.

(*a*) *Whom*—simple rel. pron. 3rd pers. sing. mas. (having a forward reference to *his* in third line), obj. gov. by *hated* and *honour*.
I—personal pron. 1st pers. mas. (or fem.) sing. nom. subj. of *hated*.
thou—pers. pron. 2nd pers. mas. or fem. sing., nom. subj. of *hast*.
me—pers. pron. 1st pers. mas. or fem. sing. obj. gov. by *made*.
thy—pron, poss. adj. attrib. to *truth* (or, poss. case of *thou*).
his—pron. poss. adj. attrib. to *ashes* (or, poss. case of *he*).

(*b*) 'Whom' is equivalent to 'him whom.' The word 'what' when used as a relative, has its antecedent similarly suppressed, as, I did what you ordered, where 'what' equals that which. It is not usual nowadays to suppress the antecedent to *who*.

2. Give the possessive case of each of the following pronouns:—Thou, He, She, Who, They.

Thou has for possessive 'thy' or 'thine.'
He ,, 'his.'
She ,, 'hers' or 'her.'
Who ,, 'whose.'
They ,, 'their' or 'theirs.'

3. Into what different classes may prepositions be divided according to their etymology (derivation). Give examples of prepositions in each class.

Prepositions may be classed as follows:—
1. Simple: as—at, by, in, on, up.
2. Compound and Derivative: as—before, around, saving, within.
3. Phrase-prepositions: as—instead of, along with, for the sake of.

Geography.

Answer two Questions.

1. Say what you know about the striking physical features of Cumberland, Carnarvonshire, Perthshire, and Kerry.
Draw little sketch maps to illustrate your answer.
(See answer to No. 3, Candidates).

2. Draw a full map of Germany.
(See any good atlas.)

3. Name six important towns in France (*not* including Paris), and say fully what you know of each.

Lyons—at the junction of the Rhone and Saone; second city in population and commercial importance; first in manufacturing industry, silk especially.

Marseilles—most ancient city in France, third in regard to population; its commerce in fruits and wines extends to all parts of the world.

Bordeaux—largest and most important city in the west of France, the third commercial port, is the great emporium of the wine trade, and one of the principal seats of its foreign commerce.

Lille—a very strongly fortified city, is one of the chief seats of the cotton, linen, and woollen manufactures.

Toulouse—the most important and populous city in the entire south of France; a southern centre for literature and science, contains the principal cannon-foundry in France.

Nantes—one of the largest and most commercial cities in the west of France, with extensive shipbuilding docks.

History.

1. Give the dates of Egbert, Athelstan, Canute, and Edward the Confessor; and name their immediate successors.

	A.D.		
Egbert, crowned king of all England	827,	suc. by	Ethelwulf.
Athelstan ,, ,,	925,	,,	Edmund I.
Canute ,, ,,	1017,	,,	Hardicanute.
Edward (Confessor) ,,	1042,	,,	Harold II.

2. When did William II., Henry II., Edward II., and Richard II., cease to reign? and who succeeded them?

	A.D.		
William II. ceased to reign	1100,	succeeded by	Henry I.
Henry II. ,, ,,	1189,	,,	Richard I.
Edward II. ,, ,,	1327,	,,	Edward III.
Richard II. ,, ,,	1399,	,,	Henry IV.

3. Write down the names and dates of our sovereigns from Charles II. to George II. inclusive.

	A.D.		A.D.
Charles II.	reigned from	1660	to 1685
James II.	,,	1685	,, 1688
William III. and Mary II. (died 1695)	,,	1689	,, 1702
Anne	,,	1702	,, 1714
George I.	,,	1714	,, 1727
George II.	,,	1727	,, 1760

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy*.

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

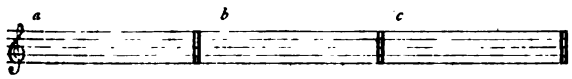
A quarter of an hour allowed for this Paper.

1. What is meant by a *sound*, what by a *tone*; and how does a sound differ from a tone?

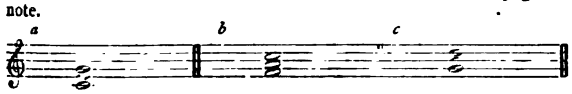
1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones. The natural scale has eight sounds, rising in successive steps by tones and semitones, the latter being found between the third and fourth, and seventh and eighth sounds.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) Do, (F) Fa, and (G) Sol



2. A *triad* is the addition of its third and fifth to any given note.



3. How many tones and how many semitones are found in the diatonic scale, and what are the places in it of the latter?

3. In a diatonic scale are found five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the simple interest on £6,901 for 292 days at 3½ per cent. per annum.

$$\text{Simple int.} = £6901 \times \frac{292}{365} \times \frac{3\frac{1}{2}}{100} = £\frac{6901 \times 292 \times 7}{365 \times 200} = £\frac{6901 \times 4 \times 7}{5 \times 200} = £193\ 4s.\ 6{\cdot}72d.$$ Ans.

2. If goods purchased at £387 4s. 0d. are sold for £433 6s. 8d., what is the gain per cent. in £ s. d.?

£387 4s. gains £46 2s. 8d.

£1 ,, £46 2s. 8d.

£387 4s.

$$\therefore\ £100 \text{ gains } \frac{£46\ 2s.\ 8d. \times 100}{£387\ 4s.} = £11\ 18s.\ 3\tfrac{6}{31}d.$$

3. Bought sugar at £2 5s. 10d. per cwt. Required the selling price per lb. on which 12 per cent. is gained.

1 lb. cost $\frac{550}{112}$d.

100 : 112 :: $\frac{550}{112}$d. : selling price required.

$$\frac{550}{112}\text{d.} \times \frac{112}{100} = 5\tfrac{1}{2}d.$$ Ans.

4. A house and land were sold for £8,963, and the owner received £8,626 17s. 9d. as the net proceeds of the sale. What was the rate of commission per cent.?

£8963 brings £336 2s. 3d.

£1 ,, £336 2s. 3d.

£8963

$$£100 \text{ ,, } £\frac{336\frac{9}{80} \times 100}{8963}$$

$$i.e.\ £\frac{26888\frac{9}{80} \times 100}{8963} = £\frac{3\frac{9}{80}}{1} = 3\tfrac{9}{80} \text{ p. c.}$$ Ans.

FEMALES.

1. Multiply $2\frac{1}{2}$, $3\frac{3}{4}$, $10\frac{1}{8}$, $20\frac{1}{3}$, and $5\frac{9}{23}$, together.

$$\frac{5 \times 27 \times 81 \times 184 \times 124}{2 \times 8 \times 8 \times 9 \times 23} = \frac{37665}{4} = 9416\tfrac{1}{4}.$$ Ans.

2. Simplify the expression:—

$$\frac{1}{13} \text{ of } \frac{1}{1 + \frac{1}{3 + \frac{1}{4}}}$$

Otherwise $\frac{1}{13}$ of $\frac{1}{1 + \frac{4}{13}} = \frac{1}{13}$ of $\frac{13}{17} = \frac{1}{17}$. Ans.

3. Express $£\frac{9}{10} - \frac{5}{6}$ of a guinea as the fraction of half a crown.

$£\frac{9}{10} - \frac{5}{6}$ gui. = 18s. − 17s. 6d. = 6d.

and 6d. = $\frac{1}{5}$ of 2s. 6d. Ans.

4. What is the amount of a bill for ¾ cwt. of sugar at 4½d. a lb., 1½ cwt. of rice at 4⅜d. a lb., 70 lbs. of currants at £2 6s. 8d. a cwt., and 25 lbs. of tea, 1½ cwt. of it costing £28 10s. 6d.

		£	s.	d.
¾ cwt. or 84 lbs. @ 4½d. per lb.	=	1	11	6
1½ ,, ,, 168 ,, ,, 4½d. ,, ...	=	3	6	6
70 ,, ,, £2 6s. 8d. per cwt. ...	=	1	9	2
25 ,, ,, £25 10s. 6d. for 1½ cwt.	=	4	4	$10\frac{3}{4}$
		10	12	$0\frac{3}{4}$

Grammar.

1. 'Nor did he *doubt her more*,
But rested in *her* fealty, till he crowned
A happy life with a fair *death*, and fell
Against the *heathen* of the Northern sea
In battle, *fighting for* the blameless king.'—*Tennyson.*

(*a*) Point out the conjunctions in the above, and assign each to its proper class.

(*b*) What are co-ordinate sentences? Show which are the co-ordinate sentences in the above.

(*c*) Parse all the words in italics.

(*a*) *Nor*—(=and not) co-ordinate copulative conj.
but—co-ordinate adversative conj.
till—subordinate temporal conj.
and—simple co-ordinative conj.

(*b*) Co-ordinate sentences are such as are not dependent on one another, or enter into the construction of each other.

The co-ordinate sentences in the above are:—

(1) '(He) rested in her fealty' in adversative co-ordination with (2) 'Nor did he doubt her more,' and (3) 'he crowned a happy life with a fair death' in copulative co-ordination with (4) '(he) fell against the heathen . . . . king.'

(*c*) *Doubt*—trans. verb, reg. infinitive, pres. indef. gov. by *did*.
her—pers. pron. 3rd pers. fem. sing. obj. gov. by *doubt*.
more—adv. of time mod. *doubt*.
death—abstr. noun. neut. sing. obj. gov. by *with*.
heathen—collec. noun. neut. sing. obj. gov. by *against*.
fighting—intrans. verb. irreg. *fight, fought, fought, incomplete part.* referring to *he*.
for—prep. relating the 'act of fighting' with *king*, and governing *king* in obj.

2. Point out the verbs in the subjunctive mood in the following sentences, and explain how you know them to be in that mood: 'O that it were with me as in days that are past;' 'Unless he try hard, he will not succeed.'

'were' is in the subjunctive mood because although it appears to be in the past indicative it refers to *present* time, and is therefore past *subjunctive.*

'try' is in the subjunctive because it follows *unless* and indicates both *uncertainty* and *futurity.*

Geography.

Answer *two* questions.

1. Name six important towns, and say fully what you know of each.

See this question answered under 1st year.

2. Draw a full map of British North America.

3. Give full notes of a lesson on 'MALTA.'

POSITION.—Situated in the Mediterranean, 58 miles S. of Sicily, and 179 miles from the N. point of Africa.

EXTENT and CHARACTER.—Little else than mere rock—stretches from N.W. to S.E.—length 18 miles—greatest breadth 10 miles—area about 95 sq. miles—about two-thirds cultivated—most of it made productive by sheer industry—climate excellent, allowing two crops every year—no streams—few springs—rain-water collected in tanks.

TOWN and PEOPLE.—*Valetta*, on N.E. coast (60,000), clean, handsome town, with one of the finest harbours in the world—very strongly fortified—a port of call for vessels to India. *Maltese*, strong and hardy—make excellent seamen—famous for making lace and jewellery—speak an Arabic dialect—are Roman Catholics.

PRODUCTIONS.—No forest trees or hedges—wild thyme in the west feeds bees which produce famed Maltese honey—whole crop of corn lasts inhabitants only three months. *Cotton* is the chief production. Vines and olives are cultivated, figs and oranges abound, and the vegetables are excellent. The asses of Malta are celebrated.

IMPORTANCE.—From its position, commercial and military, it can scarcely be over-valued. Commanding the southern coast of Europe, it is the rendezvous for the British fleet, stationed in the Mediterranean, and along with Gibraltar prevents the closing of the route to our Indian possessions.

HISTORY.—Possessed by the Knights of St. John from 1530; it was taken by the French in 1798, and these again were driven out by the English in 1800, from which time it has remained a British possession.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How came Danish kings to rule over England? Give names and dates of the sovereigns of this line.

The frequent incursions of the Danes forced Ethelred the Unready to buy off the invaders with large sums of money, which was raised by a tax called the *Danegeld.* This cowardly policy led the Danes to come in greater numbers. The two principal leaders were Sweyn and Thurkill. In 1013 Sweyn sailed up the Trent, rapidly conquered the country, and wrested the kingdom from Ethelred. Early the next year Sweyn died. Ethelred was re-called, but died soon after. The war was kept up between his son Edmund and Sweyn's son Canute. Two rival kings were elected 1016, Edmund holding all south of the Thames, along with East Anglia, Essex, and London; Canute took the rest. By the death of Edmund, in the same year, Canute became king of all England, 1017. He was succeeded by Harold I., 1035, who reigned till 1040, and was succeeded by Hardicanute, who reigned till 1042.

2. Compare the dominions of Henry II. with those of Edward the Confessor, and explain the difference.

When Edward the Confessor became king, in 1042, he had only his English kingdom, holding no possessions of his own previous to his election as king. On the other hand Henry II. was a powerful prince before he succeeded to the English crown, in 1154. He was stronger than his feudal lord, the king of France and all his other great vassals put together. *Anjou* and *Maine* he inherited from his father; *Normandy*, from his mother; and *Poitou*, *Aquitaine*, and *Gascoigne* he gained by his marriage with Eleanor. In 1171 he added Ireland to his dominions, his sovereignty being generally acknowledged in that I land.

3. Write down names and dates of the sovereigns who reigned between 1272 and 1399, and show that in this period England was under strong rulers and weak rulers alternately.

Edward I. began to reign 1272. He annexed Wales to England, decided who was to be king of Scotland, and in a great measure conquered that country. The deposition of Baliol, in Scotland, led to a second conquest of that country. Such headway did he make towards the subjugation of the Scots, that he was called the 'hammer of Scotland.' On his death, in 1307, he was succeeded by Edward II., who was already under the power of a favourite—Piers Gaveston—who had been banished by Edward I. The recall of the favourite, and Edward's incapacity, caused the appointment of the *Ordainers*, who lessened the king's power and banished Piers, who, however, returned and was beheaded. His attempt to retake Scotland from Bruce ended in his disastrous defeat at Bannockburn, 1314. Returning from Scotland, he again fell into the hands of favourites, and finally was deposed and secretly murdered, 1327.

The new king, Edward III., put in a claim to the crown of France, 1328. This led to the hundred years' war. In 1346, he gained the famous battle of Crecy, took possession of Calais, which England kept for two hundred years. Ten years afterwards, his brave son gained the battle of Poitiers; and in 1360 he held his possessions in France, not as a vassal, but as an independent sovereign.

His grandson, Richard II., succeeded him in 1377. The beginning of his reign was disturbed by a peasant insurrection, which gave the death-blow to villainage. He was wasteful, dissipated, and frivolously fond of shows and pageants. The Duke of Lancaster, having been banished by Richard, returned while the latter was absent in Ireland, and finding himself more popular than the reigning sovereign, laid claim to the throne. The Lords and Commons deposed Richard on the ground of misgovernment, and he being imprisoned in Pomfret Castle, was found murdered, 1400.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy.*

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy.*

Composition.

Write full notes of a lesson on 'METALS.'

METALS.

Definition.—Metals form one of the two great classes of mineral substances—all metals being minerals, but all minerals not metallic. (*Show as many specimens of metals as possible, and allow the children to handle them.*) Gold and silver called 'precious'—why? Iron, lead, copper, and zinc, etc., the 'useful'—why?

How found.—Metals found in two common forms—*native*, that is, in the form of pure metal; or as *ore*, that is, mixed up with other substances, from which the metal is extracted by *smelting*. *Gold* found as dust, or *nuggets*, and in quartz—describe the 'diggings.' *Silver*, found mixed with dross, in the form of ore. *Iron* is found in the form of iron-ore, and also mixed with clay and coal. *Lead* is found united with sulphur, its ore is called *galena*. *Zinc* is found in the form of ore. *Copper* is sometimes found native, but generally as an ore. *Tin*, found in the form of *tin-stone*. *Quick-silver*, a fluid metal, becomes hard when frozen.

Manufacture and Uses.—Gold and silver are used for *coins* and *jewellery*: gold, the 'king of metals,' never rusts. Too soft to be used alone; take copper or other metals to harden them. (*Ask for names of various articles made of gold and silver.*)

Iron.—Describe iron furnace with its tower; the mixing of lime, coke, and char, or ore; the melting of the whole, the tapping of the furnace, and the moulding of the molten mass into pig-iron; the process of working it into *wrought-iron*; the changing of wrought-iron into *steel*. (*Ask the children to write down on slates* (1) *large, and* (2) *small articles made of iron or steel.*)

Treat lead, copper, and zinc, etc., in similar way.

Alloys.—Gold, silver, and copper form an alloy; copper alloyed with zinc forms *brass*—with tin forms *bronze* or *bell-metal*, according to certain proportions; lead and tin form *solder*; tin and lead form *pewter*; tin, mixed with antimony and copper forms *Britannia metal.*

Where found.—*Gold* is found principally in Australia and California; *silver*, chiefly in Mexico, Chili, and Peru; *iron*, in Great Britain, Sweden, Belgium, France, and United States

lead is found in Great Britain and elsewhere; *zinc* is found in Derbyshire and Mendip Hills; *copper*, in Cornwall, Anglesea, and Australia; *tin*, in Cornwall; *quick-silver*, in Spain and South America.

Euclid.

MALES.

[*All generally understood abbreviations for words may be used.*]

1. To describe an equilateral triangle upon a given finite straight line.

What are the *data* and what the *quæsita* in this proposition? What postulates are used in the construction?

See Prop. I., Bk. I.

The *data*, that is, what is given, consists of a straight line, and the *quæsita* or what is sought is the describing of an equilateral triangle upon it.

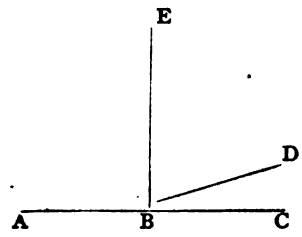
2. To draw a straight line at right angles to a given straight line, from a given point in the same.

See Prop. XI., Bk. I.

3. State and prove the corollary. In what respect is the proof unsound?

3. Corollary to Prop. XI. Bk. I. Two straight lines cannot have a common segment.

If it be possible let the two straight lines ABC, ABD have the segment AB common to both of them.



From the point B draw BE at right angles to AB.

Then because ABC is a straight line, the angle CBE is equal to the angle EBA. Also, because ABD is a straight line, the angle DBE is equal to the angle EBA. Therefore the angle DBE is equal to the angle CBE the less to the greater; which is impossible. Q. E. D.

The above proof is unsound from the fact that we do not know how the perpendicular BE is to be drawn. If we are to use I. 11. we must produce AB, and then we must assume that there is only *one* way of producing AB, for otherwise we shall not know that there is only *one* perpendicular; and thus we have to assume what we have to demonstrate.

Needlework.

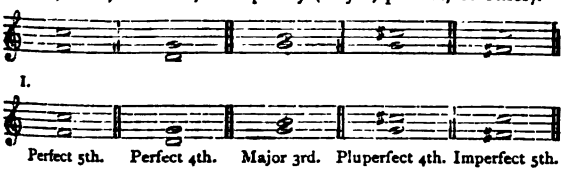
FEMALES.

One hour allowed for this Exercise.

Music.

A quarter of an hour allowed for this Paper.

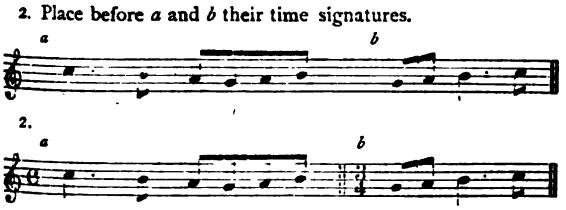
1. Write under each of the following intervals, its name (second, third, or other) and quality (major, perfect, or other).



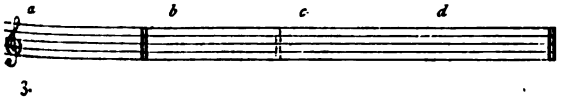
1.

Perfect 5th. Perfect 4th. Major 3rd. Pluperfect 4th. Imperfect 5th.

2. Place before *a* and *b* their time signatures.



2.

3. Write in *a* the scale signature of D (*Re*), in *b* that of F (*Fa*), in *c* that of B♭ (*Se*), and in *d* that of E (*Mi*).

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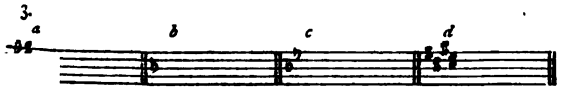

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What is the amount of the principal sum from which £270 arises as simple interest in 4½ years, at 6¼ per cent.?

Interest of £100 = £6¼ × 4½ = $\frac{25 \times 9}{4 \times 2}$ = £$\frac{225}{8}$

∴ £$\frac{225}{8}$: £270 :: £100 : principal required.

$\frac{£100 \times 270 \times 8}{225}$ = £960

∴ the amount = £960 + £270 = £1230. Ans.

2. Find the true discount on £107 5s., payable at the end of 6 months, at 3½ per cent.

Interest of £100 for 6 mo. at 3½ p. c. = $\frac{£3\frac{1}{2} \times 6}{12}$ = £1¾

Amount of do. for do. = £101¾

∴ £101¾ : £1¾ :: £107¼ : true discount.

$\frac{£429 \times 7}{4 \times 407}$ = £$\frac{21}{136}$ =

£1 16s. 10$\frac{14}{17}$d. Ans.

3. What is my interest per cent., if for every half-crown invested I receive £·00260416?

£$\frac{1}{8}$: £100 :: £·00260416 : interest sought.

£·00260416 × 800 = £2·083$\frac{1}{3}$ = £2 1s. 8d. Ans.

4. What sum when invested in the 3 per cents. at 98½, will have the nominal value of £14,536, ¼ per cents. brokerage being charged on the amount of the stock?

Nominally £100 costs £98¾

" 1 " £$\frac{787}{800}$

∵ " £14,536 " $\frac{787 \times 14536}{800}$

i.e. $\frac{114398 \cdot 32}{8}$ = £14299·79

= £14299 15s. 9½d.

FEMALES.

1. Divide ·2 by ·06 and 6·35 by ·425, each to four places of decimals, and prove the truth of the result by vulgar fractions.

(*a*)

·06 | ·20

3·3333... Ans.

(*b*)

·425) 6·35 (14·9411... Ans.

425

2100
1700

4000
3825

1750
1700

500
425

750
425

Proof of (*a*) ·2 ÷ ·06 =

$\frac{2}{10} \div \frac{6}{100}$ =

$\frac{2}{10} \times \frac{100}{6}$ =

$\frac{2}{6} \times \frac{100}{10}$ =

$\frac{2}{6} \times \frac{100000}{10000}$ =

$\frac{200000}{60000} \times \frac{1}{10000}$ =

Now $\frac{200000}{60000}$ = 33333... from above.

therefore the result = $\frac{33333}{10000}$... = 3·3333...

Proof of (*b*) 6·35 ÷ ·425 =

$\frac{635}{100} \div \frac{425}{1000}$ =

$\frac{635}{100} \times \frac{1000}{425}$ =

$\frac{635}{425} \times \frac{1000}{100}$ =

$\frac{635}{425} \times \frac{100000}{10000}$ =

$\frac{63500000}{42500} \times \frac{1}{10000}$

Now $\frac{63500000}{4250}$ = 14941... from above.

therefore the result = $\frac{14941}{10000}$... = 14·9411...

2. Compare the value of ·875 of 10s. 6d. and ·785 of 13s. 4d.

(a) $\frac{875}{1000}$ of 10s. 6d. $= \frac{7}{8}$ of 10s. 6d. = 9s. $2\frac{1}{2}$d.
(b) $\frac{785}{1000}$ of 13s. 4d. $= \frac{157}{200}$ of 13s. 4d. = 10s. $5\frac{2}{5}$d.

$\therefore$ (b) is greater than (a) by 1s. $2\frac{7}{10}$d. Ans.

3. What number multiplied by $\frac{3}{4}+\frac{5}{8}+\frac{3}{10}-1\frac{1}{8}$ will produce ·37575?

$$\frac{32+30+3}{48}-\frac{25}{48}=\frac{65-56}{48}=\frac{9}{48}$$

Therefore the number required $= \cdot 37575 \div \frac{9}{48} =$

$$\frac{37575\times 48}{900000}=\frac{4175\times 48}{100000}=2\cdot 004. \text{ Ans.}$$

4. A man having given $\frac{2}{3}$ of the money in his purse for a sheep, and ·375 of the remainder for a pig, had £1·6875 still left; what sum had he at first?

(a) After spending $\frac{2}{3}$ he had $\frac{1}{3}$ of his money left.

(b) ·375 $= \frac{3}{8}$; $\therefore \frac{3}{8}$ of $\frac{1}{3} = \frac{1}{8}$ = fraction of money paid for pig.

(c) $\frac{2}{3}+\frac{1}{8}=\frac{10+3}{18}=\frac{13}{18}$ = total fraction of money paid away.

(d) $\therefore$ £1·6875 $= \frac{5}{18}$ of total sum $\therefore$ total sum $= \frac{£1\cdot 6875\times 18}{5} =$

$$£\frac{30\cdot 375}{5} = £6 \text{ 1s. 6d.}$$

Grammar.

1. 'Hadst thou *but shook* thy head or made a pause
When I spoke darkly *what* I purposed,
Or turned an eye of doubt upon my face,
As bid me tell my tale in express words,
Deep shame had *struck* me *dumb*.'—*Shakespeare.*

(a) Point out the subordinate sentences in the above, and assign each to its proper class.

(b) Parse the words in italics.

(a) The subordinate sentences are:—

1. 'Hadst thou but shook thy head,' (conditional)
2. '(*Hadst thou but*) made a pause.' "
3. 'When I spoke darkly.' (time)
4. 'What I purposed.' (noun obj. to 3)
5. '(*Hadst thou but*) turned an eye of doubt upon my face.' (conditional)
6. 'As (*if thou wouldst*) bid me tell my tale in express words.' (manner with purpose)

(b) *but*—(only) adv. deg., mod. *shook*.
shook—(shaken) trans. verb, irreg. *shake, shook, shaken*, complete part., referring to *thou*, forming past perf. indic. with *hadst*.
what—rel. pron. 3rd pers. sing. neut., containing both antecedent and rel. obj. gov. by *spoke* and *purposed*.
As—subordinating conj., introducing an adverbial sent.
bid—trans. verb. irreg. *bid, bade, bidden*, infin. pres. gov. by (*wouldst*).
me—pers. pron. 1st pers. sing. com. obj. gov. by *bid*.
tell—trans. verb. irreg. *tell, told, told*, infin. pres. gov. by *bid*.
struck—*trans.* verb irreg. *strike, struck, struck*, complete part. referring to *shame*, forming past perf. subj. with *had*.
dumb—adj. used predicatively, qual. *me*.

2. '*And now, their mightiest quelled, the battle swerved.*' Point out the nominative absolute in this phrase, and show how a nominative absolute differs from a noun in apposition.

The nominative absolute is '*their mightiest quelled.*' A nominative absolute differs from a noun in apposition, (which is always an attributive adjunct to the noun) in being used as an adverbial adjunct to the predicate. *e.g.*:—

The sun having risen (absol. phrase), we set out.
Brown, *the draper* (noun in appos.), is bankrupt.

3. The Latin prepositions which enter into the composition of the words '*collide*' and '*support*,' are cum and sub; give the meaning of each preposition, and the rule which regulates the changes made in the spelling of prepositions in some compounded words.

Cum means *with, together with.*
Sub ,, *under.*

The rule which regulates the changes made in the spelling of prepositions in some compounded words is *Letters that cannot be easily sounded together are assimilated, e.g.*—*ad*firm becomes *af*firm; *ad*rogate, *ar*rogate; *con*-lide, *col*-lide; *sub*-port, *sup*-port; *syn*pathy, *sym*pathy.

Geography.

1. Give full notes of a lesson on 'The Journey to India by the Suez Canal.'

Illustrate by a map or maps.

I. *Routes to Alexandria.*—(a) London to Southampton—steam to Alexandria, calling at Gibraltar and Malta. (b) London to Dover—steam to Calais by rail to Marseilles, steam to Alexandria, calling at Malta. (c) London to Calais, by rail through France and Italy to Brindisi—steam to Alexandria.

II.—*Alexandria to India.*—Steam down the Suez Canal to Aden, and thence across the Indian Ocean to Bombay, Ceylon, Madras, or Calcutta.

III.—*Notes on the Journey. Gibraltar*, fortified rock belonging to Britain—'Key to the Mediterranean'; this rock and the one opposite on the Coast of Africa, called by the ancients the 'Pillars of Hercules.' *Malta*, belonging to Britain, chief town, Valetta, strongly fortified, sometimes called the 'Diamond of the Mediterranean.' *Alexandria*, chief port of Egypt. Suez Canal, constructed by Lesseps, connects the Mediterranean with the Red Sea, by means of which there is a continuous 'waterway' from Britain to India. *Aden*, a fortress of Arabia, belonging to Britain, a coaling place for steamers, and a telegraph station.

2. What do you know about *Pietermaritzburg, Plassy, Pondicherry, Port Natal, The Pruth, The Punjab*, and *Rupert's Land?*

Pietermaritzburg, the capital of the Colony of Natal, is a small town, neatly built in the form of a parallelogram.

Plassy, 83 miles north of Calcutta, in the Presidency of Bengal, is memorable for the decisive victory gained by Clive, 1757, which established British supremacy in India.

Pondicherry, the capital of the French possessions in India, is a very handsome maritime town.

Port Natal is an inlet on the coast of Natal, South Africa; D'Urban, the port of the Colony of Natal, is on its north shore.

The Pruth is a river which rises in the Carpathian Mountains, forms the boundary between Roumania and Russia, and falls into the Danube below the town of Galatz.

The Punjab—meaning the 'five rivers'—is an extensive province of British India, embracing the country watered by the Indus and its five great tributaries—the Jhelum, Chenab, Ravee, Beas, and Sutlej. It was annexed to the British possessions after the battle of Goojerat, 1849.

Rupert's Land is named from Prince Rupert, who was one of the founders of the Hudson Bay Company. It is now for the most part included in the north-west territories of British North America, but was formerly bounded by the Rocky Mountains on the W., Hudson Bay on the E., the United States on the S., and the Arctic Ocean on the N.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How many children and grandchildren had Henry VIII.? Give names and dates of such of them as came to the throne.

Henry VIII. had three children, who all came to the throne.
Edward VI., son of Jane Seymour, succeeded him and reigned from 1547 to 1553. *Mary*, daughter of Catherine of Arragon, reigned from 1553 to 1558. *Elizabeth*, daughter of Anne Boleyn, reigned from 1558 to 1603.
Henry VIII. had no grandchildren.

2. Why were the reigns of James I. and George I. likely to be disturbed? Mention any plots and insurrections in those reigns.

The reign of James I. was likely to be disturbed because, according to the will of Henry VIII., the crown should have gone to the descendants of Mary, Duchess of Suffolk. In the beginning of his reign, Sir Walter Raleigh was condemned to death for conspiring to place Arabella Stuart, first cousin of James, on the throne. He was reprieved, and Arabella un-

molested, until she married William Seymour, a descendant of the Duchess of Suffolk. This union so alarmed James that he shut Arabella up in the Tower, where she died. This plot of Raleigh's was called the Main-plot. There was another called the Bye-plot, said to be a design for seizing the king, and making changes in the government.

By showing his real feelings towards the three religious parties, the Roman Catholics were dismayed, and a few fanatics of their number got up the famous Gunpowder Plot, 1605.

George I. being a foreigner, and caring more for Hanover than for England, could never become popular; and besides, his claim was disputed. James the Pretender having put forward his claims on the death of Anne found many sympathizers, especially in Scotland. An invasion of England was planned, and the Earl of Mar's rebellion, or the rebellion of 1715, took place. Simultaneously a defeat was sustained by the Jacobites at Sheriffmuir in Scotland, and Preston in England. These disasters prevented the Jacobites from making further attempts for thirty years.

3. What do you understand by Repeal of the Union? Show that separation would be injurious to all parts of the United Kingdom.

By the Repeal of the Union is meant the cancelling of the legislative union between Britain and Ireland. Before this union, Ireland possessed a Parliament of her own, and though subject to the king was practically independent of Great Britain.

It would be injurious to Ireland, by causing a heavier taxation among a poor people, in a limitation of the free-trading that she now enjoys in common with the other parts of the United Kingdom, and from the protection which an Irish Parliament would almost be sure to make against every British manufacture. As regards the injury to the other parts of the United Kingdom, Ireland would soon be a base for enemies to carry out their designs against the British Sovereign; and in a short time Ireland would in all likelihood become the property of any foreign state strong enough and willing enough to fall in with the wishes of her demagogues. It would be very dangerous to the peace of Britain to have such a hot-bed of unreasonable, revengeful, and treacherous enemies so near her shores. These are but a few of the reasons why Britain should keep a firm hold on this beautiful but unfortunate Island.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy*.

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

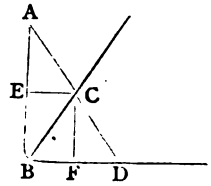
[All generally understood abbreviations for *words* may be used.]

1. If a straight line, falling upon two other straight lines, make the exterior angle equal to the interior and opposite upon the same side of the line; or make the interior angles upon the same side together equal to two right angles; the two straight lines shall be parallel to one another.

See Prop. 28, Bk. I.

2. From a given point without the angle contained by two given lines, draw a line so that the part of it between the given point and the nearer line may be equal to the part between the two given lines.

(Given A, BC, BD; bisect AB at E, draw EC ∥ BD; ACD is the line required.)



The figure being drawn according to the given construction, through C draw CF parallel to BE. Then BECF is a parallelogram and ∴ FC = BE = EA. Again the angle FCD = angle BAC, and the angle ECA = angle FDC. (I. 29.) Wherefore in the two triangles FCD, ECA, there are two angles in the one equal to two angles in the other, and the side FC = the side EA, therefore (I. 26) the two triangles are equal in every respect, and AC = CD. Q.E.F.

3. To describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

See Prop. 42, Bk. I.

Algebra.

MALES.

(Pupil teachers are expected to show that they have learnt the *proofs* of the rules.)

1. *Prove the rule* for subtracting algebraical quantities.
From $(x+y)(a+b+c)$ take $(a+b-c)(x+y)$.

1. Suppose we have to take $b+c$ from a. Then, as each of the numbers b and c is to be taken from a, the result is shown by $a-b-c$. That is $a-(b+c)=a-b-c$. Next, suppose we have to take $b-c$ from a. If we take b from a we obtain $a-b$; but we have taken too much from a, for we were required to take not b but $b-c$, that is b diminished by c. Hence we must increase the result by c; thus :—

$$a-(b-c)=a-b+c.$$

From the consideration of these cases we arrive at the following rule :—*Change the signs of all the terms in the expression to be subtracted and then add it to the other expression.*

$$(x+y)(a+b+c)=ax+bx\times cx+ay+by-cy.$$
$$(a+b-c)(x+y)=ax+bx-cx+ay+by-cy.$$
$$+2cy=2c(x+y).$$ Ans.

2. *Prove the rule* for dividing a fraction by an integer.

Simplify $\frac{a-3x}{3a+x}+2\frac{2}{3}-\frac{3a-x}{a+3x}$

2. To divide a fraction by an integer we may either (1) *multiply the denominator*, or (2) *divide the numerator by it*.

(1) $\frac{a}{b}\div n=\frac{a}{bn}$; for in the fraction $\frac{a}{b}$ the unit is divided into b equal parts, a of which parts are taken; whereas in the fraction $\frac{a}{bn}$ the unit is divided into bn equal parts of which a parts are taken; now since each part of the latter fraction is $\frac{1}{n}$th of each part of the former, it follows that $\frac{a}{bn}$ is $\frac{1}{n}$th part of $\frac{a}{b}$, hence $\frac{a}{b}\div n=\frac{a}{nb}$;

(2) $$\frac{bn}{a}\div n=\frac{bn}{an}=\frac{b}{a}.$$

$$\frac{a-3x}{3x+x}+\frac{8}{3}-\frac{3a-x}{a+3x}$$

L. C. M. of denrs. $=3(3a+x)(a+3x)$

$$\frac{3(a-3x)(a+3x)+8(3a+x)(a+3x)-3(3a-x)(3a+x)}{3(3a+x)(a+3x)}=$$
$$\frac{3a^2-27x^2-27a^2+3x^2+24a^2+80ax+24x^2}{3(3a+x)(a+3x)}=$$
$$\frac{80ax}{3(3a+x)(a+3x)}$$ Ans.

3. Solve the equation $\frac{3x+4}{14}-\frac{2x-7}{21}+2\frac{2}{3}=\frac{x-4}{4}$

Clearing of fractions—

$$18x+24-8x+28+231=21x-84$$
$$18x-8x-21x=-84-231-28-24$$
$$11x=33\frac{4}{11}.$$ Ans.

Needlework.

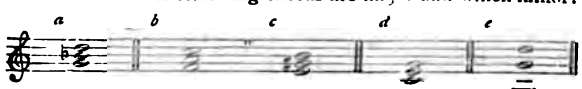
FEMALES.

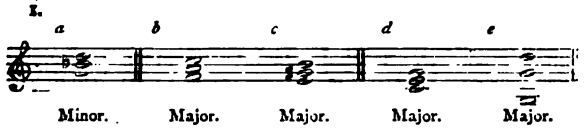
One hour allowed for this Exercise.

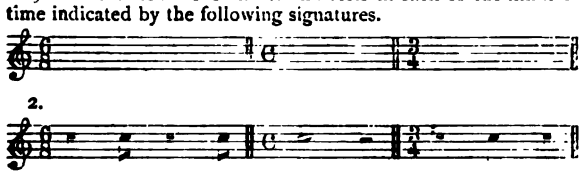
Music.

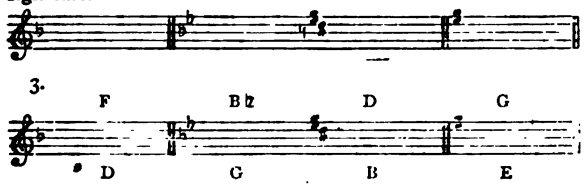
A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?



1.

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st *May*, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. I am required to invest in 3½ per cents. standing at 93⅛ a sum sufficient to provide for the payment of the rent of a house let to me at £57 15s. a quarter. What sum must I invest, brokerage ¼ per cent.?

Rent is equivalent to £231 per annum.

£3½ is got from £93⅛

1 " " $£\frac{93\frac{1}{8}}{3\frac{1}{2}}$

£231 " " $£\frac{373 \times 231}{14}$.

i.e. $£\frac{373 \times 33}{2} = £12\frac{3}{4}09.$

i.e. £6154 10s. Ans.

2 Receiving £·56875 per week of 6 days and spending 66·6 per cent. of his wages, how many days more or less than a year of 52 weeks will a boy take to save £10?

(*a*) By spending 66·6 p.c. he saves 33⅓ p.c., or ⅓ of the whole.

(*b*) ∴ daily he saves $£\frac{·56875}{6 \times 3} = \frac{136·5}{18}$d. = $7\frac{7}{12}$d.

(*c*) Hence No. of days required to save £10 = $\frac{2400}{7\frac{7}{12}} = \frac{28800}{91}$.

= 316$\frac{4}{91}$ days.

i.e. 4$\frac{4}{91}$ days more than a year of 52 weeks of 6 days each.

3. If the interest on £362 15s. for a given time at 3 per cent. be £10 17s. 7·8d., at what interest per cent. will double that principal amount to £785 7s. 11·7825d. in the same time?

(*a*) Interest on two times £362 15s. = (£785 7s. 11·7825d. − £725 10s.) = £59 17s. 11·7825d.

(*b*) £10 17s. 7·8d. : £59 17s. 11·7825d.
or
2611·8d. : 14375·7825d.
2 : 1
} :: 3 : rate required.

$£\frac{3 \times 14375·7825 \times 1}{2611·8 \times 2} = £\frac{43127·3475}{5223·6} = £\frac{431273475}{52236000} = £8\frac{41}{1740}$ p.c.

4. Find, and state in decimal form, the *average* of the following 5 quantities:—

$\frac{11}{\dot{1}}$ of ⅛, ·018, 0, 3, and $\sqrt{2\frac{7}{\dot{9}}}$.

$\frac{11}{\dot{1}}$ of ⅛ = $\frac{88}{\dot{8}\dot{8}}$ = ·353535

·018018

0·

3·

$\sqrt{2\frac{7}{\dot{9}}} = \sqrt{\frac{25}{\dot{9}}} = \frac{5}{3}$ = 1·666666

5 | 15·038226

1·007644. Ans.

NOTE.—Divide the sum of the quantities by the number of them.

5. What are logarithms, and what is the use of them? Give examples.

Logarithms may be considered as the exponents in any numerical expression.

Thus $a^x = l$. Here x is the logarithm of l to the base a, or it expresses that power to which the base must be raised to give the number.

By means of logarithms we can substitute addition and subtraction in long and involved computations for multiplication and division.

For example, in Briggs' system, every number or fraction of a number is either a power of ten, positive or negative, or lies between two powers of ten. The powers of ten are as follows:—

$10^0 = 1$; $10^1 = 10$; $10^2 = 100$; $10^3 = 1000$; $10^4 = 10000$;.....

$10^{-1} = ·1$; $10^{-2} = ·01$; $10^{-3} = ·001$; $10^{-4} = ·0001$.....

Hence the log. of 1 is 0; log. ·1 is −1

" 10 " 1; " ·01 " −2

" 100 " 2; " ·001 " −3

" 1000 " 3; " ·0001 " −4

....

10 × 100 = log. 10 + log. 100 = 1 + 2 = 3 = log. 1000.

1000 ÷ 10 = log. 1000 − log. 10 = 3 − 1 = 2 = log. 100.

FEMALES.

1. Find the amount of 1895 guineas for 4½ years at 2⅔ per cent.

Interest = 1895 gui. × 4½ × $\frac{2\frac{2}{3}}{100} = £\frac{1989\ 15s. \times 19 \times 11}{4 \times 400}$

$£\frac{415857\ 15s.}{16 \times 100} = £259\ 18s.\ 2\frac{11}{16}$d.

∴ Amount = (£1989 15s. + £259 18s. $2\frac{11}{16}$d.) = £2249 13s. $2\frac{11}{16}$d. Ans.

2. Find by Practice, the cost of 4685½ lbs. of butter at 1s. 7½d. a lb., and the cost of 39 oz. 16 dwts. 18 grs. of silver at 9s. 10d. per oz.

	£	s.	d.
(*a*) Value of 4685½ lbs. at £1 each =	4685	10	0
" " " 1s. " = 1/20 of val. at £1 =	234	5	6
" " " 6d. " = ½ " 1s. =	117	2	9
" " " 1½d. " = ¼ " 6d. =	29	5	8½
" " " ⅜d. " = ¼ " 1½d. =	7	6	5¼
" 4685½ lbs. at £0 1s. 7⅞d. each =	£388	0	4¼

	£	s.	d.
(*b*) Val. of 1 oz.	= 0	9	10
			39
" 39 oz.	=	19	3	6
" 10 dwts. cost ½ value of 1 oz.	=	0	4	11
" 5 " " ¼ " 10 dwt.	=	0	2	5½
" 1 " " 1/20 " 5 "	=	0	0	5¼
" 12 grs. " ½ " 1 "	=	0	0	2½
" 6 " " ½ " 12 grs.	=	0	0	1¼
" 39 oz. 16 dwts. 18 grs.	= £19	11	8¼	

3. If a snail crawl on the average 5½ in. in 5 min. 3 sec., what fraction, and also what decimal of a mile, would it crawl in 2·4 hours?

5 min. 3 sec. or 303 sec. : 2·4 ho. or 8640 min. :: 5½ in. : ? ½ in. × $\frac{8640}{303} = \frac{1584}{101}$ in. which reduced to the fraction of a mile = $\frac{1584}{101 \times 63360} = \frac{1}{4004}$. Decimally ·002475

Grammar.

1. '*Whoever* wishes to be well acquainted with the morbid anatomy of governments, whoever wishes to know *how* great states *may be made feeble* and wretched, should *study* the history of Spain. The empire of Philip the *second* was undoubtedly *one* of the most powerful and splendid *that* the world ever saw. If we overlook a *hundred* years, and then look at Spain, *what* a *change* do we *find*?'—MACAULAY.

(*a*) Pick out from the above a noun sentence, an adjective sentence, and an adverbial sentence; and analyse the adjective sentence.

(*b*) Parse the words in italics.

(*a*) Noun Sentence—'How great states may be made feeble and wretched,' object of *to know*.

Adjective Sentence—'That the world ever saw,' qualifying *empires*.

Adverbial Sentence—'If we overlook a hundred years,' modifying *do find*.

Analysis of Adjective Sentence.

the world ..... subject.
saw ..... predicate.
that ..... object.
ever ..... extension (of time).

(*b*) *Whoever*—comp. rel. pron. containing antecedent and rel. *he* nom. to *should study* and *who*, 3rd pers. sing. masc. nom. to *wishes*.

how—subord. conj. adv. of manner, introducing, noun. sent. and mod. *may be made*.

may—defect. verb, *may, might*, indic. pres. indef. 3rd pers. plu. agr. with subj. *states*.

be—subst. verb, irreg. *am was been*, infin. pres. indef. governed by *may*.

made—trans. verb, irreg. *make made made*, complete participle, referring to *states*.

may be made—might be parsed according to some grammarians as pres. pct. passive voice.

feeble—adj. predicative of states.

study—trans. verb, reg. infin. pres. indef. gov. by *should*, and forming with it the past pot.

second—adj. predicative of *Philip*.

one—pron. indef. 3rd pers. sing. neut. referring to *empire*, nom. after *was*.

that—rel. pron. 3rd pers. plu. neut. referring to (empires) obj. by *saw*.

hundred—num. adj numbering *years*.

what—adj. qual. *change*.

change—abst. noun, neut. sing. obj. governed by *find*.

find—trans. verb, irreg. *find, found, found*, infin. pres. indef. governed by *do*, and forming with it, emphatic form of pres. indic. active.

2. Many of our words denoting offices and degrees of rank, and many referring to the Church, are of Latin or Norman-French origin; account for this, and give examples of words in illustration.

The Romans occupied Britain for about four hundred years, and the Latin introduced by the Romans themselves is called *Latin of the First Period*. The Latin brought in through intercourse with the Church of Rome, about the time of St. Augustine, is called the *Latin of the Second Period*. The Latin that came to us through the Normans in the corrupt form of Norman-French, is called *Latin of the Third Period*. The following are examples of offices and degrees of rank:—*Canon, chancellor, constable, count, duke, equerry, lieutenant, marquis, mayor, prince, viscount*. Words referring to the Church:—*mass, preach, saint, chapter, creed, chalice*, belong to the First Period. *Baptism, Bible, ceremony, charity, friar, sacrifice, penance, tonsure*, belong to the Third Period.

Geography.

1. Draw a map of that part of the Atlantic Ocean which lies between lat. 40° N. and lat. 40° S.

See a good Atlas.

2. Give notes of a lesson to an advanced class on 'A Voyage from the Straits of Magellan to St. John's, Newfoundland,' with special attention to the river-mouths that are passed, the currents of the ocean, the prevailing winds, and the changes of climate.

RIVER-MOUTHS.—Negro, Colorado, La Plata, formed by the Parana and Uruguay, in La Plata; Grande, San Francisco, Parnahyba, Maranhao, and Amazon, in Brazil; Surinam, Berbice, Demerara, Essequibo, in Guiana; Orinoco, in Venezuela; Magdalena, in New Grenada.

San Juan, in Central America; Grande del Norte, in Mexico; Colorado, Mississippi, Mobile, Savannah, Roanoke, James, Potomac, Susquehanna, Delaware, Hudson, in United States; St. John, in New Brunswick; St. Lawrence, in Canada.

CURRENTS.—Leaving the *Cape Horn* current, we enter the *Brazil* current, which skirts the western edge of the *South Atlantic* current; pass into the *Equatorial Stream*, then into the *Gulf Stream*, which carries us to Newfoundland.

WINDS.—*Trade Winds* extend to 28° on each side of the Equator—divided by a tract of sea usually occupying a width of from 6° to 8° of latitude—this belt, called the *Region of Calms* and *Variable Winds*; Region of the *North-east* Trade Winds, north of the Equator; Region of the *South-east*, south of the Equator; north-east Trade wind blows with less steadiness than the south-east, but towards West India Islands it keeps generally steady between east and north-east.

CLIMATE.—Leaving the border of the *South Frigid Zone* we pass through the *Temperate Zone*, into a belt where the temperature is 68° Fahr. all the year round; into the *Torrid Zone*; thence again into a belt with an average temperature of 68° for whole year, and enter the *North Temperate Zone*, and at Newfoundland we are in the region where the temperature is 32° for the year.

Note.—With the pupils before a map of the Atlantic, a graphic account of the voyage may be given, showing what currents may be taken advantage of and which avoided, how to have the aid of the Trade Winds; picturing out 'crossing the Line,' and 'lying becalmed.'

SECOND PAPER.

Two hours and a half allowed.

History.

1. 'William Rufus, Henry I., Stephen, John, Henry IV., Henry V., Henry VI., Richard III., and Henry VII., all reigned in defiance of the strict rules of descent.' Show briefly the truth of this statement.

1. William Rufus was not the eldest son of the Conqueror, yet he succeeded to the throne and kept out his eldest brother Robert, Duke of Normandy.

Henry I., who succeeded Rufus, seized the throne, which ought to have gone to his eldest brother Robert.

Stephen succeeded Henry I., but Matilda, Henry's daughter, was the rightful heir.

John succeeded his brother Richard I., though Arthur, son of his elder brother Geoffrey, was the proper heir.

When Henry IV. ousted Richard II., his cousin, Edmund Mortimer, great-grandson of Lionel, Duke of Clarence, was the rightful heir.

Henry V. took the throne, although that same Edmund Mortimer was living.

Henry VI. was descended from the *third* son of Edward III., while the Duke of York, who contended for the crown, was descended from the *second*.

Richard III. usurped the throne which ought to have belonged to Henry, Duke of Richmond, the last male descendant of the House of Lancaster.

Henry VII. had not such a strong right to the throne as Elizabeth of York or Edward, Earl of Warwick, son of the Duke of Clarence, another representative of that House.

2. Napoleon I. wrote in 1807 to his brother, then King of Holland, 'you have none but nobles about you; the opinion of these persons is always in direct contradiction to that of the public.' Quote some conspicuous examples from our history to invalidate this assertion.

Godwin, during the reign of Edward the Confessor.
Lanfranc, in the reign of William the Conqueror.
Anselm, Archbishop of Canterbury, in the reign of Rufus.
Stephen Langton, Archbishop of Canterbury, in the reign of John.
The *Earl of Pembroke* and *Simon de Montfort*, under Henry III.
The *Earls of Warwick* and *Lancaster*, under Edward II.
The *Dukes of Bedford* and *Gloucester*, under Henry VI.
Lord Clarendon, under Charles II.
William Pitt, Earl of Chatham, under George III.

3. At what periods since the Conquest was this country likely to have kings named Arthur, Eustace, Frederick, Henry IX.?

In 1199, Arthur of Brittany should have been king instead of John, his uncle.

Had Eustace lived, he very possibly might have succeeded his father Stephen in 1154.

Frederick, son of George II., would have come to the throne in 1760 had he not died nine years before his father.

Had James II. and his descendants not been disinherited, his grandson Henry, Cardinal of York, might have succeeded his brother Charles Edward, who died 1788.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy*.

Composition.

Write a short essay on *The Post Office*.

Previous to the seventeenth century there is nothing heard of a Post Office. From the state of society only the business of State demanded correspondence. The most complete step taken in the establishment of a Post Office was in 1657, when an Act was passed to settle the postage between England, Scotland, and Ireland. This has been the model of all subsequent measures on the subject. Up to 1838 a great many Acts of Parliament were passed. At that date the Rev. Rowland Hill began to mature those plans which were to revolutionize the postal system. He proposed the daring suggestion that all the existing rates of postage should be abolished, and their place taken by a uniform rate of *one penny*, regardless of distance, the carriage of the letter to be *prepaid* by means of *stamps*. This plan was condemned among the upper classes, but the country at once warmly approved of it, and at length it was adopted by Parliament. The example of England was gradually followed by every civilized State.

About twelve years ago some of the most important latest changes were made. The halfpenny postal-card was introduced, and reductions in the charge for books, patterns, etc., were made. About the same time foreign postage was reduced. Now, connected with the Post Office, we have Money-orders, Life Annuities, Insurance, a Dead-Letter office, and the Telegraphs. Under the present Postmaster-General various convenient reforms have been and are likely to be made.

The transmission of mails in this country, as regards regularity and safety, will compare favourably with that of any nation in the world, and although not in all respects perfect, it approaches to that standard more closely than any similar establishment.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If a straight line be divided into any two parts, the squares on the whole line, and on one of the parts, are equal to twice the rectangle contained by the whole and that part, together with the square on the other part.

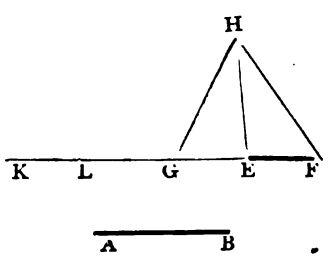
Produce a given line so that the rectangle of the whole line produced, and the original line shall be equal to a given square.

(*a*) See Prop. 7, Bk. II.

(*b*) Let EF be the given line (obviously less than AB the side of the given square.)

From E draw EH perpendicular to EF and equal to AB the side of the square.

Join HF, and at the point H in HF make the angle FHG= the angle GFH, then GH=GF (I. 6.)



Produce FG to K, making GK=GF or GH. Now, because KF is divided equally in G and unequally in E, the rectangle KE·EF+square on GE= square on KG (II. 5), or square on GH. But the square on GH= squares on GE and EH. ∴ the rectangle KE·EF + square on GE=the squares on GE and EH.

Take away the common square on GE and the rectangle KE·EF=square on EH, which is equal to the side of the given square. ∴ If from FK a part FL be cut off equal to KE, then FE shall have been produced so that the rectangle LF·FE is equal to a given square, namely, the square on AB.

2. To describe a square that shall be equal to a given rectilineal figure.

See Prop. 14, Bk. II.

Algebra.

MALES.

(Pupil Teachers are expected to show that they have learnt the *proofs* of the rules.)

1. *Prove* that $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$, the letters representing any numbers.

Reduce $\frac{27x^2 - 57x - 14}{39x^2 - 64x - 63}$ to lowest terms.

1. (*a*) Let $\frac{a}{b} = x$ and $\frac{c}{d} = y$ then $a = bx$, and $c = dy$

$\therefore ac = bdxy$;

hence dividing each of these equals by bd,

$$\frac{ac}{bd} = xy$$

but $xy = \frac{a}{b} \times \frac{c}{d} \therefore \frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ Q.E.D.

(*b*) $\frac{27x^2 - 57x - 14}{39x^2 - 64x - 63} = \frac{(9x + 2)(3x - 7)}{(13x + 9)(3x - 7)} =$ in lowest terms $\frac{9x + 2}{13x + 9}$

2. *Prove* that in any equation any quantity may be transferred from one side to the other without affecting the result, the sign of the quantity so transferred being changed.

Solve (1.) $13x - y = 1 = x - 31y$.

(2.) $132x^2 = 1 - x$.

2. This is proved by means of the axiom or self-evident proposition, that '*if equal quantities be added to or subtracted from equal quantities the sums or remainders will be equal.*'

Let $x + a = b$

subtract a from each side of the equation. Then

$x + a - a = b - a$

but $a - a = o$

$\therefore x = b - a$

Where a is on the right side, with sign changed.

Again, let $x - a = b$

Add a to each side of the equation. Then

$x - a + a = b + a$

or $x = b + a$

Where a has changed its side and its sign.

(1) $13x - y = 1$ or $13x - y = 1$ or $403x - 31y = 31$

$x - 31y = 1$ „ $13x - 403y = 13$ „ $x - 31y = 1$

by subtracting $\therefore 402y = -12$ and $402x = 30$

$y = -\frac{6}{201}$ $x = \frac{15}{201}$

(2) $132x^2 = 1 - x$

$132x^2 + x - 1 = o$

breaking up left side of equation

$(12x - 1)(11x + 1) = o$

hence $12x = 1$

$\therefore x = \frac{1}{12}$

or $11x = -1$

$\therefore x = -\frac{1}{11}$

i.e., $x = \frac{1}{12}$ or $\frac{1}{11}$. Ans.

3. A man started on an errand at the rate of $3\frac{3}{4}$ miles an hour, and half an hour afterwards another was sent to overtake him, which he did in 2 hours; what was his rate?

Let x miles=rate of the second per hour.

then $2x = 3\frac{3}{4}$ mls. $\times 2\frac{1}{2} = \frac{55}{6}$

$12x = 55$

$x = 4\frac{7}{12}$ miles per ho. Ans.

Mensuration.

MALES.

The rent of a four-sided field is £31 4s., at £3 4s. per acre, and the sum of the perpendiculars on the diagonal is 143 yards; what fraction of a mile is the diagonal?

Area of field = £31 4s. ÷ £3 4s. = $\frac{634}{64}$ = 9·75 ac.

Now the diagonal multiplied by the sum of the perpendiculars gives two times the area.

$\therefore$ diag. $\times$ 143 yds. = 9·75 $\times$ 2 = 19·50 ac.

diag. $= \frac{19{\cdot}5 \text{ sc.}}{143 \text{ yds.}} = \frac{195 \times 4840}{1430}$ yds. $= 15 \times 44 = 660$ yds.
and 660 lineal yds. $= \frac{660}{1760}$ ml. $= \frac{3}{8}$ mls. Ans.

Needlework.

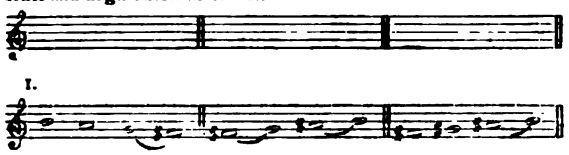
FEMALES.

One hour allowed for this Exercise.

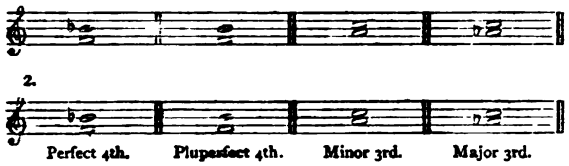
Music.

A quarter of an hour allowed for this Paper.

1. Write the upper tetrachord of B (Si) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.

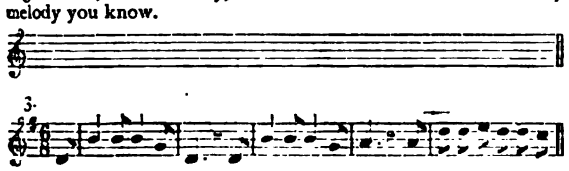


1.

2. Write, under each of the following pairs of notes, the name and quality (major, perfect, diminished, or other) of the interval it forms.

2.

Perfect 4th. Plupasfect 4th. Minor 3rd. Major 3rd.

3. Write, from memory, the first four or more measures of any melody you know.



3.

—o—

Publications Received.

Botany—
(1) Twining's Lectures on Plants. W. Poole.
Classics—
(1) Bell's Cambridge Texts. Geo. Bell and Son.
Geography—
(1) Map Drawing Books. Philip & Son.
(2) British School Atlas. Gall & Inglis.
(3) Shilling National Atlas and Sixpenny. W. & A. K. Johnston.
(4) Maps. W. & A. K. Johnston.
Geometry—
(1) Hulme's Plain Geometrical Drawing. Longmans.
History—
(1) Johns' History of England. Crosby Lockwood & Co
(2) Tables of English History. T. Laurie.
Miscellaneous—
(1) Pascoe's Everyday Life in our Public Schools. Griffith & Farran.
(2) Spencer's Bicycle Road Book. Griffith & Farran.
(3) Lamb's Tales from Shakspere. Whittaker & Co.
(4) Dictionary of Mythology. Whittaker & Co.
(5) Plutarch's Lives. Whittaker & Co.
(6) Handy Classical Dictionary. Whittaker & Co.
(7) Hossfeld's Methods of Learning Foreign Languages. W. Poole.
(8) History of Shorthand. W. H. Allen & Co.
Music—
(1) Burlington Song Book. R J. Derfel.
Periodical Literature—
(1) Ward & Lock's Universal Instructor, XVIII. Ward, Lock & Co.
(2) Book of Sports. Cassell & Co.
(3) The Monograph. Q. P. Index.
(4) Oxford Examiner, III. Thos. Laurie.
(5) Our Little Ones, VI. Griffith & Farran.
Reading Books—
(1) Blackie's Graded Readers. Blackie & Son.
Scripture—
(1) Abraham's Manual of Scripture History. Trübner & Co.
(2) Scripture Manuals—St. John. T. Murby.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

EXERCISE IV.

(1) $32b$. (2) $-48bc$. (3) $1002xyz$. (4) $68abc$. (5) $-112xyz$. (6) $1366mp$. (7) $13a+13bc-21c$. (8) $11a+25b-12c$. (9) $27x-23y+12z$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

(No. 3.)

STANDARD III.

A. 1. 16,980—3.
2. 22,263—23.
3. 6923—606.
B. 1. 1084—78.
2. 16,628—62.
3. 404—715.
C. 1. 25,165,824.
2. £3906 12s. 6½d.
3. £66,259 12s. 4d.
D. 1. £30 2s.
2. 130—21,210.
3. £11 15s. 1½d.
E. 1. £939 5s. 8¾d.
2. 770,574.
3. £128 7s. 3d.
F. 1. 412—55,560.
2. £54,166 13s. 4d.
3. £31 2s. 6d. gain.

ADVANCED EXAMINATION.

1. £1 16s. 8d. gain.
2. £6,930,993 19s. 9⅜d.
3. £17 2s. 9d.

STANDARD IV.

A. 1. £10,942 5s.
2. £49,757 4s. 0¾d.
3. £5120 2s. 3⅜d.—5.
B. 1. £2901 18s. 0⅜d.
2. £61 13s. 7¼d.—29.
3. 79 coats, and 1 yd. 2 qr. 1 nl. left.
C. 1. 104d. 8h. 26m. 55s.
2. £66 0s. 1¾d.—24,884.
3. 29 gross of needles.
D. 1. 223 ton, 14 cwt. 3 qr. 23 lb. 5 oz.
2. 646,719¾ sq. ft.
3. £546,057 3s. 6¾d.
E. 1. 209,952 c. in.
2. 8s. 6½d.
3. 13s. 7½d.—29,710.
F. 1. 3 ton 12 lb.
2. 15,488d. 4h. 37m. 39s.
3. 1,212,960 beans.

ADVANCED EXAMINATION.

1. 2760 oranges.
2. £12 7s. 6d. each ox.
3. 153 caps.

STANDARD V.

A. 1. £28 7s. 9¾d.
2. £641 0s. 7½d.
3. £2877 1s. 8½d.
B. 1. £3342 4s. 8½d.
2. £8437 18s. 5½d.
3. £7219 14s. 0½d.
C. 1. £41,250 4s. 3d.
2. £255,684 17s. 5d.
3. £58,654 6s. 3d.
D. 1. £394 15s. 8½d.
2. £8032.
3. £599 3s. 8½⅓d.
E. 1. £5,201,857 11s. 6¾d.
2. £3378 18s. 1½d.
3. £1437 3s. 2⅝d.
F. 1. 90.
2. £44 11s. 3d.
3. £87 0s. 4½d.

ADVANCED EXAMINATION.

1. £7 11s. 11½d.
2. £167 6s. 10½d.
3. 8s. 9d. m., 6s. 3d. w., 2s. 6d. b.

STANDARD VI.

A. 1. $3\frac{4}{10}$.
2. $4\frac{1}{3}$.
3. $\frac{7}{17}$.
B. 1. ·61875.
2. 2000.
3. 4s 1⅞d.
C. 1. $31\frac{7}{8}$ acres.
2. $3\frac{3}{5}$ hours.
3. $6\frac{1}{2}$ hours.
D. 1. $2\frac{9}{33}$.
2. $\frac{4}{1697}$.
3. £1214 3s. $8\frac{4}{33}$d.
E. 1. £7 16s. 8¾d.
2. 741⅝ oz.
3. 281¼ yds.
F. 1. ·063.
2. ·01103+.
3. 68 to 75 (A to B).

ADVANCED EXAMINATION.

1. 5 to 4.
2. $29\frac{1}{2}\frac{1}{3}\frac{1}{7}\frac{1}{8}$.
3. £166 4s. 8·808d. (gain).

STANDARD VII.

A. 1. £1 2s. $1\frac{3}{7}\frac{1}{9}$d.
2. £126 19s. 10½d.
3. $2\frac{1}{3}\frac{1}{3}$ per cent.
B. 1. 1,025,750 min.
2. ·0808701+.
3. £6 10s. 7⅛d.
C. 1. $3\frac{4}{10}$ years.
2. 7500 persons.
3. £3716 8s.
D. 1. £2272 14s. $6\frac{8}{11}$d.
2. £4350.
3. £149 9s. 6·127872d.
E. 1. £38¼.
2. £6 11s. $2\frac{1}{7}$d.
3. £100 17s. 7⅛d.
F. 1. 63·25.
2. 3·75.
3. $85\frac{5}{17}$ per cent.

ADVANCED EXAMINATION.

1. $53\frac{1}{3}$m. past 12.
2. £6690 14s. 0⅛d.
3. 235·339+ yards.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

STANDARD III.

1. 1200 × 5 = 6000 herrings bought.

	£	s.	d.
1000 sold at 1d. each =	4	3	4
3500 „ „ ½d. „ =	7	5	10
1500 rem. „ 5 for a d. =	1	5	0
Total selling price =	12	14	2
Deduct the cost =	10	17	6
Gain	£1	16	8 Ans.

2.

£	s.	d.	
7,012,010	0	2	
81,016	0	4½	
£6 930,993	10	9½	Ans.

3.

£	s.	d.	
1	17	6½	baker's bill.
0	16	10¼	
2	14	4¾	butcher's bill.
4	11	11½	sum of the two bills.
0	12	6	
3	19	5¼	grocer's bill.
8	11	4½	draper's bill.
		2	
£17	2	9	Ans.

STANDARD IV.

1. 60 is a number of dozens and also a number of fives, and 60 cost 4½d. × 5 = 1s. 10½d., and there being 12 fives in 60 they will sell for 2d. × 12 = 2s.; hence the gain on 60 oranges is 2s. − 1s. 10½d. = 1½d. Then 5s. 9d. ÷ 1½d. = 46 the number of *sixties* bought, and 60 × 46 = 2760 oranges. Ans.

2.

£	s.	d.		£	s.	d.
22	15	0	× 20 =	455	0	0
17	2	6	× 50 =	856	5	0
			70 =	1311	5	0

£1277 10s. + £157 10s. = £1435 total selling price; then £1435 − £1311 5s. = £123 15s. selling price of the remaining 10 bullocks, and £123 15s. ÷ 10 = £12 7s 6d. Ans.

3.

	yd.	qr.	
2 yd. 3 qr. 1 nl. × 24 =	67	2	coats.
2 qr. 2 nl. × 18 =	11	1	vests.
	78	3	coats and vests.

Then 100 yds. − 78 yds. 3 qr. = 21 yds. 1 qr. for caps. Bringing both 21 yds. 1 qr. and the 2 nl. ½ in. to inches, we have 765 in. ÷ 5 in. = 153 caps. Ans.

STANDARD V.

	£	s.	d.
1. 14 lb. at 1⅛d. an oz., *i.e.*, 2s. 4d. a lb. =	1	12	8
21 lb. or 1½ st. at 27s. 4d. a cwt., *i.e.*, 3s. 5d. a st. =	0	5	1½
1½ cwt. or 168 lb. at 6½d. a lb. =	4	11	0
3½ oz. at 6s. a lb., *i.e.*, 4½d. an oz. =	0	1	3⅜
2½ cwt. at £15 15s. a ton, *i.e.*, 15s. 9d. a cwt. =	1	15	5½
4 lemons, *i.e.*, ⅓ of a doz., at 7½d. a doz. =	0	0	2½
	8	5	9
Less 165¾d., as £8 5s. 9d. = 165¾s.	0	13	9⅜
Ans.	£7	11	11½

2. 1 qr. 3½ lb. = 31½ lb. × 150 = 4725 lb., 3s. 10½d. ÷ 11 = 4¼d. price of *half* a lb., or 8½d. a lb.; 4725 lb. at 8½d. = £167 6s. 10½d. Ans.

3. Bringing all the shares to their equivalents in boys' shares we have—

48 boys' shares = 48
18 men's shares = 18 × 3½ = 63
32 women's „ = 32 × 2½ = 80
Total boys' shares = 191

	£	s.	d.		s.	d.	
Hence	23	17	6 ÷ 191 =	2	6	a boy's share	Ans.
	0	2	6 × 2½ =	6	3	a woman's „	
	0	2	6 × 3½ =	8	9	a man's „	

STANDARD VI.

1. 80 × 5 = 400 lb. eaten by 40 men in 6 days, hence 400 lb. ÷ (40 × 6 = 240) = 1⅔ lb. eaten daily by a man.

Again 240 × 4 = 960 lb. eaten by 90 women in 8 days, and 960 lb. ÷ (90 × 8 = 720) = 1⅓ lb. eaten daily by a woman. Hence the ratio is 1⅔ to 1⅓, that is, 5 to 4. Ans.

2.

$(2\frac{3}{5} + 5\frac{4}{6}) = (2\frac{18}{30} + 5\frac{20}{30}) = 8\frac{11}{30}$ sum
$5\frac{4}{6} - 2\frac{3}{5} = 3\frac{7}{30}$ diff.
$(2\frac{3}{5} \times 5\frac{4}{6}) = (\frac{13}{5} \times \frac{34}{6}) = 15\frac{6}{30}$ prod.
$(1\frac{13}{15} \div \frac{34}{6}) = (\frac{28}{15} \times \frac{6}{34}) = \frac{28}{85}$ quot.
$(\frac{34}{6} \div \frac{13}{5}) = (\frac{34}{6} \times \frac{5}{13}) = 2\frac{10}{78}$ quot.

$29\frac{1484}{2535}$ Ans.

N.B.—The least common denominator is 13650.

3. 10·375 × 2240 = 23240 lb. of currants. 23240 ÷ 2 = 11620 lb. at ·085 cr., *i.e.*, £·02125 a lb., 2·06 × 2240 = 4614·4 lb. at ·0275 of 15s. 9d., *i.e.*, at £·02165625 a lb., and 23240 − (11620 + 4614·4) = 7005·6 at £·0185 a lb. And 295·45 guineas = £310·2225, then

£·02125	× 11620 =	£246·925
£·02165625	× 4614·4 =	99·9306
£·0185	× 7005·6 =	129·6036
Total selling price		£476·4592
Deduct cost		£310·2225
		£166·2367 =

Ans. Gain £166 4s 8·808d.

STANDARD VII.

1. First find the fraction of an acre mown by A and B before C comes at 7.30, A having been working 1½ hours and B ½ hour, and having done respectively $\frac{3}{20}$ and $\frac{1}{16}$ ac.

Hence $\frac{3}{20} + \frac{1}{16} = \frac{17}{80}$ ac. done at 7.30.
$1\frac{7}{80}$ ac. $= \frac{137}{80} = \frac{1320}{960}, -\frac{17}{80} = \frac{1303}{960}$ ac. to be done by A B and C.
$\frac{1}{20} + \frac{1}{16} + \frac{1}{12} = \frac{37}{240}$ frac. of ac. done in an hour.

Then $(\frac{1303}{960} \div \frac{37}{240}) = (\frac{1303}{960} \div \frac{74}{240}) = 5\frac{83}{148}$ hrs. = 5 hrs. $23\frac{19}{37}$ m., time occupied after 7.30 a.m., hence the work is finished at 12.53$\frac{19}{37}$ p.m. Ans.

2.

	£	
1/20	6000	worth at 16
	300	less £175 = 1st year's saving.
1/20	6125	worth at 17
	306·25	„ 2nd year's saving.
1/20	6256 25	worth at 18
	312·8125	„ 3rd year's saving.
1/20	6394·0625	worth at 19
	319·703125	„ 4th year's saving.
1/20	6538·765625	worth at 20
	326·93828125	„ 5th year's saving.
	6690·70390625	= worth at 21
£6690 14s. 0 1/16d. Ans.		

3. 300 × 200 = 60 000 sq. yds., area of the rectangular field. As the square field is £65 an acre, and the other only £60, the required field will be only $\frac{60}{65}$ or $\frac{12}{13}$ of 60,000 sq. yds. 55384·615384 + sq. yds., area of the square field. But the area of a square is the square of the side, hence the square root of this number is the length of the side = 235·339 + yards. Ans.

THE COUNCIL OF THE MICE.

Allegretto spiritoso. *mf* *Music by* T. CRAMPTON.

1st TREBLE.
2nd TREBLE.
BASS.

1. One sum - mer eve, when all was still, When not a soul was wak - ing, When
2. In so - lemn rows they sat a - round, Their mourn - ful fate la - ment - ed, How
3. At last a mouse of as - pect grave—While thoughts of woe dis - tressed them— A
4. They hailed with joy the words which fell, In songs of tri - umph sang it; But

KEY A. *Allegretto spiritoso.* *mf*

1st TREBLE. ,s, | m ,d .d ,d :d ,d .d ,d | r ,m .f ,s :m ,d . ,d
2nd TREBLE. ,m, | s, ,s, .s, ,s, :s, ,s, .s, ,s, | t, ,d .r ,t, :d ,m, . ,s,
BASS. ,d, | d, ,m, .m, ,m, :m, ,m, .m, ,m, | s, ,s, .s, .s, :d, .d, . ,m,

fai - ries danced by ev - 'ry rill, And elves a stroll were tak - ing— With - in a farm - er's
cats their dear - est haunts had found, And all their lives tor - ment - ed. "Is there no way," they
joy - ous squeak of tri - umph gave, And in these words ad-dressed them: "A - round his neck we'll
when the mouse pro-duced the bell, No one was found to hang it! So, still the cat, with

E. t. f. A.

t,m ,s .s ,s :s ,s .s ,m | r ,m .f ,s :m ,d . , | d s, | s, ,m .r ,d
s,d ,m .m ,m :m ,m .m ,d | d ,d .t, ,t, :d ,d . , | t, f, | m, ,s, .s, ,s,
s,d ,d .d ,d :d ,d .d ,m | s ,s .s, ,s, :d ,d . , | m t, | d ,d .m, ,m,

emp - ty barn, In plea - sant sum - mer wea - ther, The mice, se - cure from chance of harm, In
cried in grief, "This dread - ful foe to van - quish? No way for us to find re - lief From
hang a bell, And, in a mo - ment's twink - ling, Of his ap-proach 'twill sure - ly tell, And
fcot - step light, The mice is still tor - ment - ing; And still in ma - ny a quiet night We

:t, ,l, .l, ,l, | l, ,f .r ,d :d ,t, . ,s, | s, ,s .m ,d :l, ,r .f ,r
:f, ,f, .f, ,f, | f, ,l, .f, ,f, :m, ,r, . ,f, | m, ,m, .s, ,s, :f, ,f, .l, ,f,
:f, ,f, .f, ,f, | r, ,r, .f, ,f, :s, ,s, . .t, | d ,d .d ,m, :f, ,f, .r, .r,

Symph.

coun - cil met to - ge - ther,
days and nights of an - guish?"
warn us by its tink - ling."
hear the mice la - ment - ing.

Symph.

t, ,d .r ,m :r ,d . , | s | f ,l .s ,f :m ,s .f ,m | r ,m .f ,s :m ,d .-
r, ,m, .f, ,s, :f, ,m, . , | d | t, ,d .r ,s, :d ,ta, .l, ,s, | t, ,d .r ,t, :d ,m, .-
s, ,s, .s, ,s, :d, ,d, . , | m | r ,d .t, :d .d, | s, .s, :d
.s2 :d,

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Vol. I. of the *Practical Teacher* is now out of print.

The New President of the National Union of Elementary Teachers.

WE this month present to our readers a portrait of Mr. Richard Sykes, the new President of the National Union of Elementary Teachers. Mr. Sykes is a native of Yorkshire, and it was a happy coincidence that he should have been called upon to preside over the annual conference in the county of his birth, and within so short a distance of Dewsbury, his native town. Born in February, 1841, Mr. Sykes is now in his forty-second year. He, however, looks younger, and we believe that even few of his colleagues on the Executive credit him with the full experience his long professional career has given him.

He was educated in the National School, Dewsbury, and afterwards became a pupil teacher in the same school. At the close of an apprenticeship of five years, during which he had won the esteem of all connected with the school, he obtained a Queen's Scholarship, and in 1861 entered the York Training College. Here he remained for two years, and after passing with success the various college and Government examinations, he was, early in 1863, appointed to the Head Mastership of the National School, Hyson Green, Nottingham. In this school Mr. Sykes remained for a period of sixteen years, during which he succeeded in raising it to a high pitch of excellence, gaining year by year excellent reports from Her Majesty's Inspectors. In 1879 he was appointed by the School Board for London to the Head Mastership of the Gillespie Road Board School, Highbury, N., a position he still occupies, and in which he has continued his successful professional career.

Mr. Sykes has always taken great interest in the work of Teachers' Associations, and was an active member of the 'Associated Body of Church Teachers.' He was the Secretary of the Nottingham branch when the 'Associated Body' held its last conference in that town in 1870. At this meeting, which was attended by Mr. Thomas Smith, as the representative of the London Church Teachers, it was agreed to dissolve the denominational 'Body,' and a resolution was carried in favour of establishing a union embracing all sections of teachers

For the active part taken by Mr. Sykes in this conference, and for his fervour in supporting the movement for substituting a general professional union for a sectarian organisation, he was nominated by the officers of the 'Associated Body' to the post of First President of the National Union. He, however, declined the honour, on the ground that in the interest of the new Union a man of greater age and experience should be appointed. Mr. J. J. Graves, who had been the General Secretary of the 'Associated Body' for some time, and who had probably devoted more time to the organisation of the profession than any other living teacher, was ultimately nominated and elected as 'First President of the N.U.E.T.'

Mr. Sykes was present at the first conference of the Union, held in King's College, London, as a representative of the Nottingham Association. In supporting the following addendum to the 'Objects of the Union'—'to raise a fund to secure to teachers public protection and social security'—he said:—

'The National Union, unlike its predecessor, the "Associated Body," threw open its doors to all sections of Elementary Teachers, and its Executive, instead of being scattered throughout the country, were concentrated in the metropolis. These were great steps in advance. Like former associations, however, it lacked one vital element of success and permanency, without which its career would be fitful, short, and comparatively useless. This necessary element was a large fund of money, which would serve as a fortress behind which they might entrench themselves against all assailants, and which should enable them to speak boldly and determinedly upon all questions that concern the welfare of those they strive to protect. Teachers could not be expected to subscribe their money unless real, tangible benefits could be secured to them in return. Let the Union adopt a bold, vigorous policy, and these benefits would easily follow. Let it declare that it aimed at succouring the oppressed, relieving the sick, assisting the unemployed; that it strives to infuse into each individual member independence and courage to withstand those who would degrade his position, by imposing upon him labours foreign to school work, or incompatible with the dignity of his profession. Let it assist each member to obtain a remuneration commensurate with his services, and secure to him a certainty in the tenure of his office.

'There is nothing Quixotic or chimerical in striving to attain these objects. They cannot be attained in any other way than by assimilating the National Union to that of a Trades' Union devoid of its evils. An association aiming at the realisation of such tangible objects would not fail in drawing towards it the great majority of the Elementary Teachers of the country; and

they would not demur to pay sixpence or a shilling per *week* instead of per *annum*. If two-thirds of the teachers in the country subscribe sixpence a week, what a powerful fund would be accumulated in one year. The subscription of 10,000 teachers at this rate would amount to £13,000 per annum. A fund like this would enable the union to take immediate action on all questions concerning the welfare of its members, individually and collectively. Paid officials would be employed, who would devote their whole time and energies to the work, would listen to their grievances, and endeavour to remedy them. Each teacher would perceive it was his special benefit to join, and that his money would not be fruitlessly and vainly spent. A National Union worthy of the name, embracing in its fold its thousands, would then be founded, and would have within it the elements of permanency and success.'

The Nottingham idea was not accepted at the time, but two years later the third annual conference at Manchester practically endorsed the proposal.

We believe that the views of Mr. Sykes on the policy the Union have not undergone much change since 1872, ugh the experience he has acquired during the past years, by a wider acquaintance with teachers, and greater knowledge of public work and business he possesses, have modified his ideas as to the means which effect may be given to this policy.

n 1873 Mr. Sykes was one of the selected candtes for the post of General Secretary of the Union, stood second in the election at Bristol, when Mr. er was appointed to that office. He filled all the s of the Nottingham Association, and repred it in nearly all the annual conferences of Union since 1872. He was the First President e North Midland District Union, doing good ce in that capacity and in the earlier arrangements e Nottingham Conference. Mr. Sykes has been he first an earnest supporter of the Teachers' Bene- and Orphanage Fund. For three successive years been Chairman of the Council of the Orphanage phan Fund, and to him may be attributed the first idea of a Conference Bazaar, carried out with so much success at Nottingham in 1879. At the twelfth conference of the Union, held in Lambeth last year, Mr. Sykes was elected by a large majority the Vice-President of the Union, and he now succeeds Mr. Langler, B.A., as President.

While in Nottingham Mr. Sykes did not confine his attention to the mere routine of his scholastic and professional duties, but took an active part in the promotion of general education. In conjunction with the Rev. J. B. Paton and others, he aided in establishing the series of evening schools and classes for technical and industrial instruction which have done, and are still doing, so much for the trade and town of Nottingham. In this respect Mr. Sykes has shown himself to be an able and enthusiastic educationist. He had earned the respect and gratitude of his fellow-teachers by his devotion to their interests, and we congratulate the union in securing so suitable a man as its thirteenth President. We wish him much success in his year of office, and we have little doubt that the vigour, enthusiasm, and experience which he possesses, will carry the National Union to higher points of success and influence than it has previously attained.

Monthly Notes.

THE NATIONAL UNION OF ELEMENTARY TEACHERS.—ANNUAL CONFERENCE AT SHEFFIELD.

THE Thirteenth Annual Conference of the National Union of Elementary Teachers was held at Sheffield during Easter week. Owing to its convenient and central position the great manufacturing town in South Yorkshire was well attended by the representatives of the

numerous branches of the parent Union, and the Conference was one of the most successful that has been known. Many teachers were, no doubt, induced to attend from the fact that Sheffield is within easy reach of some of the best scenery in England—that about Chatsworth and Matlock; and others were perhaps tempted to put in an appearance by the attractions of the 'Old English Fayre,' which formed a prominent feature of the proceedings, and proved a great financial success. Mr. Mundella, Vice-President of the Committee of Council on Education, was present at the Annual Banquet in the Albert Hall, and also at the 'Fayre,' which was opened by his daughter, in the absence of Mrs. Mundella, who was too unwell to leave home. The weather was exceedingly fine during the first two or three days, and, although it turned out very wet towards the end of the week, the Conference, of which we append a full report, passed off pleasantly, and was in all respects a success.

MONDAY.

The First Session of the Conference was held at Firth College, on Monday, April 11th, the chair being taken at two o'clock by Mr. J. R. Langler, B.A., President of the N.U.E.T., who was accompanied to the platform by Mr. Sykes, the President elect, and the Executive of the Union. Mr. Langler having declared the Conference open, and the standing orders having been read, and the minutes of the last conference confirmed, a vote of thanks to the retiring president was moved by Mr. Dawson, and seconded by Mr. Bowden. After the hearty adoption of the motion by the meeting, Mr. Langler said :—

I can, to some extent, understand the great cordiality with which this generous vote has been received. I am here in the midst of many old friends, some of whom I have not seen since they were at college, and who, though they recognise me, would probably be not so readily recognized in return. I cannot assent that the office has been a sinecure. Many have been the anxieties of the year, especially in connection with the New Code, and heavy indeed has been the labour, but the ready vigour of the Vice-President, the hearty co-operation of the members of the Executive, and the never-failing care of the Secretary have enabled me to discharge the duties entrusted to me twelve months ago. I am happy to know that our Union is increasing not only in numbers but aiso in influence. It is not a great unwieldy body without vital power. All its parts do not as yet exhibit equal signs of life, but I believe that as our principles are better understood very few qualified teachers will hesitate to accept them, and I confidently expect a rapid accession to our influential as well as to our numerical strength. I assure you I leave this chair with confidence to my successor, Mr. Sykes, who, with more youthful vigour, and equally earnest devotion, will for the next year occupy the proud position of President of the National Union of Elementary Teachers. I have now great pleasure to introduce Mr. Sykes.

Mr. SYKES, who was received very heartily, then proceeded to deliver his address, of which we give the most noteworthy passages :—

Ladies and Gentlemen,—In bidding you a hearty welcome to this, our twelfth, annual Conference of the National Union of Elementary Teachers, I have to congratulate you upon its continued prosperity, progress, and usefulness; and upon its increase of 1,200 members during the past year. Three hundred and twenty associations, which embrace within their folds more than 13,000 teachers, are now affiliated to the Union. We have thus active and vigorous branches spreading themselves throughout the whole of England and Wales. The continued success and prosperity of our organization is cheering to us, and gives us hope that gradually the great majority of elementary teachers will consider it their duty and privilege to range themselves under its banner. Attempts from time to time have been made to engraft new principles upon the organization. Many ardent Unionists believed that these principles would have secured a more numerous following and achieved more rapidly solid and tangible results. The Union, however, has been slow to adopt any principles which would have proved unacceptable or obnoxious to the outside public. Yet, withal, its steady progress, its acknowledged usefulness, its many achievements, have won for itself the admiration and devotion of all true believers in the future prosperity and usefulness of the profession it aims to protect, assist, and promote. It has laboured steadily and successfully to leave its impress upon the educational history of the last ten years. It has not hesitated to strike boldly at what it considered pernicious, and to advocate as resolutely what it held to be just and right.

The N. U. E. T. and the New Code.

The National Union of Elementary Teachers considers it its duty to oppose many of the additional requirements demanded by the 'Proposals for the revision of the Code.' Let it not, however, be inferred irom this that the Union is in favour of a narrow and restricted curriculum for the children attending elementary schools. On the contrary, it has consistently advocated a generous and comprehensive education, limited only by the capacity of the children to receive it, and the time at the teachers' disposal to impart it. A syllabus which aims at more than this will inevitably result in disappointment. The overcrowding of the mind will only result in confusion. In the estimation of the Union, the present Code contains ample materials for the furnishing of the intellect of the children attending our schools. Our desire should not be to increase the quantity of knowledge imparted but to improve the quality. It is impossible to crowd into school-life all the varied subjects which the fancy of specialists desire. 'Music is charming;' therefore, say the musicians, 'Compel all our children to sing by note.' It is essential, in these æsthetic times, that our clothes should be properly made; 'therefore compel every little girl to become a perfect seamstress.' The poor man's dinner is not always properly cooked; therefore cooking must form part of the school work. The whims of the specialists carry them further than even such apparently necessary requirements as these. In America, one authority on education believed in the necessity of telegraphy; therefore every child in his school was set to work clicking at telegraph keys. And even in one of the School Boards in England, a member had a craze for the subject of phrenology; therefore he gravely advocated the necessity of phrenology as a subject that should be understood by the teachers, and taught in the schools. All these subjects may be essential to the complete education of our children; but is it necessary that they should be compulsorily taught? Let the subjects in the schedule of specifics be as numerous as possible. But let the selection be left with the teachers, that they may be able to adapt their teaching to the requirements of their district, and to select those subjects which they feel specially able to teach.

Classification of Children.

Children may be divided, according to their mental ability, into three classes—the clever, the dull, and the average child. The knowledge of this fact would always be present before the teacher, when classifying his children, if his liberty of action were not crippled by the irrational and absurd classification by age demanded by the Government Code. A teacher, anxious for the progress of all his children—the dull and the clever, the forward and the backward—would, as much as possible, arrange children of similar attainments together. He would never dream of allowing the disparity which now exists between the two ends of a class to continue for twelve months at a stretch. He would never allow the quick children—the hares in the race—to comparatively waste six months of the year in order that the slow-paced snails, might reach the same mark before another onward start was made. As soon as one portion of ground was well travelled over, thoroughly surveyed and known, an advance forward into fresh pastures would be made. The snails would crawl along at a pace compatible with their abilities. Special help would, of course, be rendered them. The teacher would, however, take care that they travelled along the road with those they would not be a drag upon, but with those with whom they were fairly handicapped, and with whom the emulation engendered by a chance of winning would operate in spurring them on to exert themselves to reach the goal as rapidly as their scant ability would allow. Let classification by merit operate, and at once would cease that dull level of mediocrity which so often characterizes the children in our schools. We should see our upper classes more forward in their work, and pursuing studies which now have no place in the school; and the teacher would not be disheartened by the serious loss of time and energy necessitated by the vain attempt to drag the dull up to the level of the quick.

Teachers' Certificates.

The teachers' certificate has had a most chequered career. Its transformations have been varied and peculiar. Doubt and uncertainty have always hung around it. Originally money value attached to it. It was then a prize worth possessing, and only those qualified by good scholarship could win it. In 1862 the New Code ruthlessly swept away all that gave it dignity and worth. During the ten years that the shadow of Mr. Lowe's Code brooded over the land the certificate was a distinction scarcely worth struggling for. It was distributed among persons possessing very little scholarship, and few of the qualifications for the post of teacher. Subsequent revisions of the Code have tempted to either improve or impair its power and dignity. They have either added to or diminished the amount of knowledge required to obtain it. It has never been the complete possession of its owner. Government has always retained a hold over it, and has, at its discretion, cancelled or suspended it, and endowed with a favourable or unfavourable report. It has, in fact, been made rather a weapon wherewith to correct and chastise, than

an honourable distinction of which one might feel proud. The present Vice-President, however, has striven to free the certificate from some of the imperfections which tended to detract from its dignity and value. No teacher, unless he has passed in the second year's papers, will be allowed to teach pupil-teachers. No certificate in future will be granted without examination. And after a first-class has been obtained, the annual endorsement will cease. These are satisfactory steps in the way of improvement. 'My lords,' however, are of opinion that the certificate, thus elevated and improved, does not represent sufficient scholarship for our future elementary teachers. Inducements, therefore, are held out for university graduates to our ranks. Graduates are promised that they will become eligible for head-masterships in our schools if they work one year as assistants, and earn the certificate by examination. Few graduates, except the worthless, will be attracted to our work by this simple bait. Those who offer themselves as assistants will have, no doubt, looming before their eyes the inspectorate. It is possible that in future even inspectors' assistants, from whom sub-inspectors are to be made, will not be appointed unless they have graduated at one of our universities. It must be a source of pleasure to all earnest educationists to find that the university degree is not considered too high a mark of scholarship for teachers in elementary schools. This is a great step in advance from the gloomy period ushered in by the Revised Code. Let us hope that the time is not far distant when one of the essential qualifications for a public teacher will be the possession of a university diploma. The Hon. L. Stanley recently advocated in the columns of one of the magazines the opening of the universities to elementary teachers. He says:—'It is much to be wished that our old universities could open their doors somewhat to elementary teachers. At present unattached students at Oxford can live and study there for £50 a year. The State pays £100 for a student who completes two years at a training college; why should it not pay for a two years' residence at Oxford or Cambridge? In that case the universities might organize a course by which an elementary schoolmaster might graduate there, and so come in contact with a wider range of social influence than he now does at the training college; and the universities might appoint special teachers who would give instructions in all the branches, which are more especially needed for schoolmasters.' If this advice were acted upon, our present training colleges might be utilized as training institutions in the art of teaching, and subserve the same purpose as the hospital schools for the medical profession. During almost the whole of the two years spent at a training school, a student is engaged receiving instructions in similar subjects to those required for the examination of the B.A. degree. At the most, a month or six weeks are spent in practising and model schools learning the newest methods, and seeing the supposed best arrangements and organizations of schools. This could easily be provided by each university town. Professors of the art of teaching would be able at the universities to give far superior insight into the methods of teaching and training the young than that given by the method masters at our training colleges; for our training college method teachers are, as a rule, selected because of their eminence in the science of teaching, but chiefly because they are prepared to accept a small remuneration for the work. The teacher's diploma would, of course, demand practical skill in the art of teaching. This should be as necessary as the skill required by the doctor before he is allowed to minister to the sick; or the lawyer before he is admitted to practise in the courts. A compulsory system of apprenticeships for all teachers would ensure that this practical skill were possessed. Each university town could easily adapt one of its elementary schools to that of a model school in connection with a training college. The best appliances, the most approved methods, and the most skilful teachers might be seen there. It might, in fact, afford to the university student ample opportunity for gaining an insight into the best modes of organizing and conducting a school.

Concluding Remarks.

The necessity for a powerful and vigorous organization becomes daily more patent. After this Conference let each of us return to our respective districts firmly resolved to do our share in urging our brethren to activity and zeal in behalf of our cause. Let us strengthen our Union by rallying to its standard those who yet stand aloof from us. The National Union of Elementary Teachers has achieved much in the past. It has much yet to accomplish. It will, I believe, be the main instrument in elevating our profession to that position its dignity and importance deserve. Let us, above all, ever keep before our gaze a lofty ideal of our work and of our responsibilities. Let us lose no opportunity to foster pure thoughts and noble motives in the minds and hearts of the children entrusted to our charge; and, amid the gloom and depression that Codes and examinations may cast around us, let us not lose heart, but be sustained by a firm and sure conviction that if our work be rightly and faithfully done, our reward will be found in the purer and better lives of the generation that shall follow after us.

Mr. GIRLING said it was a pleasure to move a vote of thanks to the President for his services during the past year as Vice-president, and for the address he had just given them. He had assiduously discharged his duty in the past, and the address was a most able one. The motion, having been seconded by Mr. Hodgson and put to the meeting, was carried with acclamation, and was acknowledged briefly by Mr. Sykes. The report of the executive to Conference for the past year was then read. It touched upon the relations of the Union with the Education Department, the Inspectorate, supply of Teachers, Pensions and Compulsory Annuity Fund, Parliamentary work of the year, the Goffin case, the Appointment of Inspectors, Organization and Finance, Co-operation with other Public Bodies, the Union's Executive Machinery, and References from the last Conference. Mr. Wild moved, and Mr. Traill seconded, a resolution to the effect that the Report should be received, adopted, and printed for circulation, which was agreed to unanimously. After this Mr. Clark moved a resolution respecting the appointment of the Assistant Secretary, which submitted that the election was not made in accordance with the spirit of the resolution passed at the Lambeth Conference. The discussion was continued by Messrs. Sadd, Clarkson, and Pitt, after which Mr. Langler explained the circumstances of the appointment and said that he had no doubt about Mr. James doing his work well. The resolution was lost by a large majority. The Treasurer's Report and the Report of Auditors, which, together showed the Financial affairs of the Union to be in a flourishing condition, were then read and ordered to be printed. Votes of thanks to officers for their services during the past year were carried unanimously, as was also a motion for the reception of the reports of the Teachers' Benevolent Fund, the Orphanage and Orphan Fund, and the Teachers' Provident Society.

The Second Session was held in the evening, when Mr. Greenwood moved a vote of thanks to the Education Department for their efforts in the cause of education. He said that Lord Spencer and Mr. Mundella had honestly striven to do their best, and the thanks of teachers were due to them. Mr. Rankilor seconded the resolution, which, after some discussion, was carried by a large majority. The President then announced that Mr. C. J. Dawson, B.A., had been elected Vice-President for the ensuing year. Mr. Dawson, who was much cheered, said that they had conferred a great honour upon him. He would strive during the time of his probation to make himself worthy of their confidence. A very excellent and interesting paper on 'The Further Education of Children after leaving the Day-School,' was then read by Mr. L. W. Potts, who was heartily thanked for his kindness, on the motion of Mr. Carlyon. Mr. Heller moved:—

'That in view of confirming and extending the education of children leaving day-schools, some systematic scheme of work connecting these schools with technical and scientific institutions is both necessary and desirable.' He believed that the country owed more in the way of real secondary education, and in the way of advancement from the lower classes to the higher, to the elementary teacher than to any other class. It had long been a trouble to the teachers to find much of their labours had been thrown away by the lack of a proper bridge between the lower schools and the higher. Teachers had done something themselves to make up for this deficiency. They wanted their schoolchildren to have some systematized means of extending their further education. There was, unfortunately, a great tendency at the present day to act as though people had no practical belief in education, and he wanted that Conference to speak out boldly on the point. He did not believe in the cry of over-education; so far from that, our country was falling behind in the race, and they must improve it by extending their education. Moral improvement for their old scholars, also was wanted, and if they took hold of their children at a critical age and gave them employment, it would do great good. He wanted the country to see that the elementary teachers were in earnest over this cause.

The resolution having been supported by Messrs. Baker, Thornton, and Traill, was carried. Mr. Langler then brought up the report of the Special Committee on Constitution and Election of the Executive, which was received. The Conference then adjourned, on the motion of Messrs. Bowden and Moore.

TUESDAY.

The Third Session was held on Tuesday morning. After the consideration of a motion respecting quarterly drawing examinations and its negation by the meeting, Mr. A. E. Kirkham read a paper on 'Thrift among Teachers,' in the course of which he enumerated some of the advantages of the Teachers' Provident Society. He said their duty was plain. It was to assist ungrudgingly, and to the best of their ability, those of their brethren who were poor and helpless, and the fatherless and the widow. They would do this all the more thoroughly by practising those habits of Thrift which fill the open hand of charity, and without which benevolence itself would be little more than a name. After the reading of his paper Mr. Kirkham proposed :—

'That in the opinion of this Conference, the Teachers' Provident Society affords to teachers exceptional advantages, and is deserving of their cordial support.'

The resolution was warmly supported by Messrs. Greenwood, Gardner, Day, and Langler and was carried unanimously. The Scotch and Irish Deputations were then introduced to the Conference by the President and accorded a cordial reception. Mr. Mackay and Mr. McMillan, the Scotch delegates, addressed the meeting and were followed by Mr. O'Farrell, the Irish representative, whose fifth attendance this was. Votes of thanks were accorded to the Deputations, on the motion of Mr. Langler, seconded by Mr. Dawson, and supported by the President. Mr. Scotson moved—

'That it is desirable that steps should be taken to secure the direct representation of teachers in Parliament,'

and said that when the rapid growth of education was considered, it would be seen that no class required more direct representation in Parliament than teachers. Mr. Girling seconded the resolution, which was carried by a large majority, after which the Conference adjourned.

The 'Olde English Fayre' at the Cutlers' Hall was opened at one o'clock by Miss Mundella, who was accompanied on the platform by Mr. Mundella, the Mayor of Sheffield, the Master Cutler, and many others. A procession of the stall-holders, who were attired in picturesque costumes of bygone days, was held round the banqueting hall before the opening ceremony commenced. The Mayor having expressed the pleasure he felt in presiding, introduced Miss Mundella, who begged to assure those present of her mother's great regret that she was unable to be present on that very interesting occasion. She heartily wished success to the efforts of all its kind friends throughout the week, and had great pleasure in declaring the bazaar open.

Mr. MUNDELLA, who was received with loud and prolonged cheers, said :

They were to do the best they could to realize an object which ought to be at the heart of every elementary teacher, and it was becoming in the English public, who owed so much to the teachers, that they should assist to the utmost in their power to realize that which the teachers aspired to—to help those who were afflicted and distressed in the time of their utmost need. He was speaking rather to those who were outside the ranks of elementary teachers, and he wanted to plead in a few words—they would be inadequate, perhaps, to the occasion—for the object which the teachers had in view that day. None knew better than he did how much that Benevolent Fund was needed. He would say nothing of the orphan fund—that must be known to everybody. Gaps in the ranks of the bread-winners were constantly occurring, and there must be need frequently to find some home for an orphan child; but for the teacher who was stricken down by ill-health, mental or physical weakness, there was nothing but his own savings and such help as his brethren could render him in his distress. He knew of no class in the community who were so utterly helpless or so utterly deprived of the power of continuing their work as the teacher was either when his physical or mental health failed him or was lacking for the moment. There was nothing, too, that demanded the full exercise of all the human powers of mind and body more thoroughly than the teaching of a school, and there was nothing more distressing than to see a teacher in failing health, in suffering, and especially in mental distress, endeavouring to teach a school. During the last week he had the painful task—it was one of the most painful tasks of the year—of distributing the few pensions and the few gratuities that were allotted. It was the fourth or fifth time he had had to do it, and he, therefore, knew something of the condition of the elementary teachers. He knew in how many instances, without any fault on their part, by a sudden visitation of Providence, many a teacher was stricken down, rendered helpless, and brought into the greatest distress. Sometimes it was a sudden failing of eyesight; sometimes a sudden failing of nerve power—and he could not conceive anything more needful than that the association should have the means of giving assistance at a time like that. Having said those few words, he wished to ask his Sheffield friends, as well as visitors from a distance, not to mind—what should he say—the trouble which ladies and gentlemen sometimes regard bazaars as causing, and not to say, 'Well, the articles are not useful,' and sometimes, perhaps, 'they are not ornamental,' but let them remember the good they were doing by contributing their mites to that most useful fund. Havind said that, having said all he could to induce his constituents, his friends around him from far and near, to open their purses and buy liberally, the best thing he could do would be to give them on opportunity of making their purchases, and to ask his friends to join him in making purchases as speedily as possible. He wished most heartily success to the bazaar, and to the cause for which the bazaar was promoted.

After a vote of thanks to Miss Mundella, the bazaar was opened for business, which went on briskly during the remainder of the week, the sum of two thousand pounds being cleared on the sales.

The Conference Dinner was held in the evening at the Albert Hall, which was tastefully decorated for the occasion. The President of the Union occupied the chair, and was supported by the Right Hon. A. J. Mundella, F.R.S., M.P., the Hon. E. Lyulph Stanley, M.P., the Mayor of Sheffield (M. H. C. Serby, F.R.S.), Mr. C. T. Whitmell, M.A., Mr. J. R. Langler, B.A., Mr. C. Dawson, B.A., and the Rev. Dr. Cocker. Amongst those present were the Rev. S. Earnshaw, Professor Carnelley, E. H. Hunter, Esq., the Master Cutler (J. E. Bingham, Esq.), Professor V. Jones, the Rev. W. H. Dallinger, F.R.S., the Rev. Canon Walshaw, the Rev. J. B. Draper, the Rev. H. Sandford, Mr. W. C. Leng, Dr. Howard, &c., &c.

After the usual loyal toasts, Mr. Heller proposed the toast of the 'Education Department,' and said he was glad that the respondent to the toast that evening was the virtual head of the department—Mr. Mundella. The anxiety and care which the the right hon. gentleman had shown on more than one occasion, clearly proved that he had the greatest sympathy with their difficulties, and that good time would do much for them. Mr. Mundella, who was received with great cheering, said :—

The Education Department has grown so rapidly, both in numbers and responsibilities, that it occupies a considerable space in the minds of men and in the Budget of the present day. The time will be in the recollection of most of you when the number on the roll of our elementary schools were under a million, and when the number of H.M.'s inspectors was some twenty or thirty. The whole thing was then in a nutshell, and was therefore much easier to handle than it is now. To-day the Education Department is responsible for the education of nearly five millions of the children of this country. It has relations direct and indirect with nearly a hundred thousand teachers; with some thousands of School Board and School Attendance Committees, and with many thousands of school managers; and automatically, by a process which nobody can prevent, I am satisfied that its annual expenditure must steadily increase. I don't regret that; I speak frankly. I rejoice at it. Indeed, perhaps, for a member of an economical Government, there is no man who has done so much in the past to promote that increase, and there is no man who will in the future do more to promote than I shall myself. The Education Department, as Mr. Heller has said, is a very complicated body. He has spoken of its many members, and of its various ramifications. But there is one gentleman to whom Mr. Heller did not refer—I mean the Lord President.—I assure you there is no man to whom I am personally more indebted than to the Lord President for any support I have had in effecting any good in the way of promoting education or in ameliorating the condition of the teachers. It is not many noblemen who will forego all political patronage for the sake of improving the organization of the inspectors. The Lord President has done that. Since the present Government has been in office, there has been but one appointment to the inspectorate, and that was for Wales, where a Welsh-speaking inspector was required. All others had been kept in abeyance with a view to that reorganization which I think you all agree the present condition of education requires, and with a view to ensure for teachers not young and inexperienced men, fresh from university, but experienced, practical, sensible, and just men who will endeavour on some uniform principle, to meet out the awards and the honours of the Department. And I say that the Code which has now become law—it became law last week

would never have been submitted to Parliament except on the condition that we could so reorganize the inspectorate as to ensure that its application should be even, uniform, and just. When you have a kindly word to say, or a kindly thought to express of the Department, let me commend to you the name of my noble friend Earl Spencer. (Cheers.)

been the witness of it, and till I had myself put their labour to the test. Let me now come to a class that you frequently speak of, I am afraid, with a little harshness, that you have all in your minds at this moment, and who have been for some time past objects of your apprehension, and lately of your suspicion—I mean Her Majesty's inspectors. (A voice: 'Some of them.')

Yours faithfully
C. J. Mundella

Mr. Heller has spoken of the permanent officials. With regard to that I must say that if any of you think hardly of the permanent staff in Downing Street, you do them a gross injustice. There is no class of men that I have ever come in contact with who are more desirous of being just, fair, and considerate than the heads of the permanent officials with whom I daily come in contact. More industrious and painstaking men I have never met with, and some of them do an amount of labour which I could hardly have given permanent officials credit for till I had myself

I am very glad to hear you say some of them; because in the ranks of Her Majesty's inspectors are some of the most distinguished educationists in the world. I am afraid to mention names lest I should be invidious, but I am sure some present will forgive me if I mention the name of Arnold. I mention it because of the illustrious educational descent he has—of his old services in the cause of education. There is the name of Fitch, the name of Sandford—aye, and let us be just, my friends, don't you know some inspectors' assistants? They were your former

colleagues in the work, and worthy of all honour, and esteem, and confidence. And do you think that those of us who have education at heart—not the education of any particular school, or of any class of schools, not Board schools, not voluntary schools, not this class or that class, for we want all the schools, and they are all indispensable and we can part with none of them—do you think those of us who have education at heart, when we come to reorganize our scheme of inspectors, shall not know our men, and shall not so select them that they shall discharge their duties with honour to themselves, with equity to you, and with satisfaction to the public? Passing from this part of this subject, I come to myself. Mr. Heller has spoken very kindly of what I have done—very kindly, but with qualified kindness. But I speak of Mr. Heller with unqualified kindness. I will say to you elementary teachers, you are fortunate to have your cause in his hands. It will be a bad day for you when you lose him, you will find it hard to replace him, for in all my relations with him—and my relations with him did not begin when I became Vice-President of the Council, they went a long way back, when I was advocating relief from many of your little grievances, and many of the frictions from which you have been relieved. All my relations with Mr. Heller satisfied me with his courtesy, his tact, his good judgment; his whole gentlemanly feeling in everything was so marked and conspicuous that you will do well to retain his services so long as he lives and you can keep them. (Cheers.) Mr. Heller made some reference to the Code. I am not going to justify my Code here. I leave the Code to justify itself, if it can, by time and experience. It may be defective, but whatever its defects may be, or whatever its merits, time and experience will try them, and I hope that I, or whoever may succeed me, will be sufficiently candid, sufficiently fair and just, if he finds defects, to know how to remedy them; but if he finds improvements he will not be wanting in courage to introduce them, and if he finds we are right, whether you approve or not, we must stand by it. All we desire is to give education to the people of this country, the success of education with as much happiness and comfort to the educators as is possible in any Code to administer: but, ladies and gentlemen, do not let me deceive you. Any one who tells you that the British Parliament will pay exclusively for machinery without any regard to results, that it will go on voting millions—and increasing millions—without any test or measurement, any one who tells you that will deceive you. I shall be no party to deceiving you. I have done my best to relieve you from everything that is harsh and derogatory—(cheers)—and I trust that in the working of the Code it will be found that we shall have less friction, more comfort, more success, and less of those harassing and unpleasant reminiscences such as attached to a great deal of the working in the past. But I will say this to you, I have thought this out on every side. I have been aided by the ablest men I could call in my Council—by your best friends. At the present time I can present to the British Parliament no better document for the regulation of the education of the country than the one which it has been my privilege to give to them, and I have found no scheme yet which entirely got rid of payment for results. (Hear, hear.) There is one scheme which will be submitted in a few days—and I took it up to scan it carefully—from a friend of mine, a former Vice-President—Lord Norton. (Applause and hisses.) What does he say? That Treasury aid might be given in general and tested reports on a graduated scale. Say, for example, to amount to one-half the nett cost of the school if it appeared, by frequent and casual inspection, and test examinations—considering always the circumstances of the school—that it was in vigorous work. ('Oh'.) To one-half, of that amount if the school be indifferently but honestly conducted, the passes of children not being considered up to fair expectations of the circumstances of the school. ('Oh'.) Whenever a grant is wholly withheld, specific grounds of refusal must be assigned. Well, I know this has been very carefully thought out. But what about the frequent and casual inspection and test examinations? Who is to decide whether a school is in vigorous work, or whether it is only indifferently but honestly conducted? The whole question then is to be absolutely in one lump in the hands of H.M. inspectors. I want to know what voluntary schools could carry on under the terror of losing one-half of the whole grant on the mere word of an inspector? You all know that is an impossibility. We have given you—we have exacted from you—I think that, Mr. Chairman, is the term—we are exacting 100 per cent. Nobody exacts or expects anything of the sort. It is an abuse of language to say we do exact it. The fact is, there is a standard, and I never heard of 100 per cent. being less than 100. I never heard of per cent. being less than 100, and I say this, we shall in future have passes weighed as well as counted, and the teacher who is the Arnold of the elementary school, who introduces kindliness, heartiness, intelligence, sympathy, into that school, will, I hope, be rewarded for that which now cannot be weighed and measured by the percentage of passes. Now, Mr. President, I read this morning with a good deal of interest your very able and eloquent address of last night. As your guest it would be ungenerous of me to criticise it, but let me say where I agree with you. I agree with you, sir, that we are only at the beginning of our educational system. We have a primary system, a system of elementary education, and then we have a blank. The last time I attended a meeting of elementary teachers it was in Boston, in the United States. Now we are grumbling about our expenditure here. I believe in London—that sink of extravagance—my hon. friend who will come after me will no doubt tell you something about it—I dare say the School Board spend 3s. per head per annum of the whole population in education. In Sheffield here it comes to something like 2s. per head, it may be a trifle over—280,000 is the population, to £30,000 per year, so that will be about it. What do you suppose they spend in Massachusetts? Fifteen shillings per head for the whole population. I had sent me a few days ago the last French enactment on education. It is the largest—I was going to say the most lavish—thing that has ever been done in the history of the education of the world, and it goes from the elementary school up to the university, and makes the elementary schools the third grade schools, and the second grade schools nearly all free, and gives art instruction, and science instruction, and school education in all three. And so, throughout Europe this is going on, and as Englishmen of the future will have to compete with all these nationalities, and will have to hold their own in the race—and, I hope, too, will have to share the dignity and prosperity of our great empire—I hope that Englishmen will receive the same amount of education, or, if possible, a higher education than that given in any other country of the world. There is one thing you are expecting of me, and everybody is urging it, and I shall do my best to carry it out. That is to say, as average attendance is the basis of the Code, I say that School Boards and School Attendance Committees shall do their duty. (Loud Cheers.) I am resolved, at the risk of any unpopularity which may attach to my labours, that if any of them are recalcitrant I shall use the power which Parliament has vested in me—and I will co-operate with you teachers in that—to insure that children shall come into your schools. (Cheers and cries of "Magistrates.") Oh! they are not in my Department. (Laughter.) But I have got a screw for them. If you are wise, you can help me in that. We will ask the Archbishop of Canterbury and the whole bench of bishops to put the screw upon the magistrates to do their duty in all the rural districts of England. When the magistrates are told that the poor parson is sacrificing his little earnings, or a considerable portion of them in order to maintain the school; that the teachers are there; that the school buildings are there, and waiting for the scholars, and you, the magistrates, are not doing your duty, I think if the National Society and the Bench of Bishops would do their duty they could show the magistrates that in the interests of the schools, in the interests of education, aye, and in the interests of labour—perhaps that would come home to them as soon as most things—in the interests of labour, they could show that the child should go early to school and regularly to school, and should continue at school till he has passed the standard of exemption. Let me beseech you, my friends, before I sit down, to take courage for the future. Don't be discouraged or daunted. Don't believe that you are mere 'pass grinders,' I beseech you. Let me ask you to consider who you are, and what are your duties; that on you devolve the most important duties that can devolve upon any class of Englishmen; that the formation of the national character is in your hands—that the destinies of the English people will be greatly swayed by the principles and conduct inculcated in our elementary schools, and believe me, Englishmen in the long run are not unjust. They will recognize good services, and if I do injustice, somebody will come after me who will recognize all the good service you do. But if I do you injustice, if my successors are unjust to you depend upon it the Arnolds, the Lancasters, the Pestalozzis, and all the educationists of the past have worked for something higher than mere State reward, and that the noblest reward you can have is the esteem and affection of those that you are training in paths of virtue, and the reward of a good conscience. (Loud and prolonged cheering.)

The Hon. E. L. Stanley, M.P., proposed the toast of 'The National Union of Elementary Teachers,' which was replied to by the President, who briefly indicated the object of the Union—the advancement of the education of the country, the promotion of the educator's interests, and the establishment of funds for the amelioration of the condition of distressed teachers, and their orphans. Other toasts followed and were replied to, the proceedings terminating with that of 'The Chairman.'

WEDNESDAY.

The Fourth Session was held on Wednesday afternoon, when the Executors for the ensuing year were chosen, and a long discussion held on the Compulsory Annuity Fund. The President having announced that the poll for the place of next Conference had resulted in favour of Newcastle-on-Tyne. Messrs. Birkby and Traill thanked the meeting for their goodness in selecting that town, and promised the Union a hearty welcome next year. Mr. Maidment moved:—

'That the subscription to the Union shall not be less than 5s. per annum.'

He said the Union had done good work, but had not accomplished nearly what it could have done had there been a larger subscription. Mr. Chambers seconded the resolution, which, after a long discussion, was carried. The Conference adjourned after the transaction of business respecting the alteration of Rules.

THURSDAY.

The Fifth Session was held on Thursday, and was commenced by Mrs. Burgwin reading a paper for Miss Muller, who was obliged to be absent, entitled 'Over Pressure in Schools.' A vote of thanks having been accorded to Miss Muller for the paper, Mrs. Burgwin moved :—

'That this Conference is of opinion that great injury has been inflicted upon teachers and scholars by the over-pressure of work under the Education Code, particularly in girls' and mixed infant schools; that no relief is afforded by the New Code just issued; and that it is desirable, in the interests of education, that the curriculum in elementary school should be less diffuse, or that the standard of examination adopted by many Inspectors should be reduced.' She looked at the question from a practical point of view—that is, from her own experience. The subject was a difficult one and, to some extent, unwelcome. At first sight it would seem that we argued for idleness, or wished to teach that moral doctrine of the Catechism—contentment. But the question was to what extent should we intensify the struggle of life. At present we have merely succeeded in driving laughter from our playgrounds—playgrounds no more, but drill grounds and places for reading lessons, weather permitting. We are driving mirth from our schools. Should we substitute ambitious industry for cheerful work? Was it worth while to attain to the state of mind of the old Roman, who found nothing to wonder at? Over-pressure had chiefly been brought about by teachers themselves; those who worked for percentages were the cause of the raising of the Standard of Examination. It was similar to the struggle between armour plates and heavy guns. Each in turn was increased in weight, until the ship at last sunk from the weight of what was intended for her protection. With regard to needlework, the Department acted from statements of teachers themselves, and specimens of work they had sent to the Department. The Needlework Schedule could not be worked in school hours. Until forced, she would never work the scheme. If all mistresses had refused to work it, it would not have been retained. Infants' school had ceased to be the delight it formerly was. It was now the blot on our educational system. She would not allow a child of hers to attend an infant school.'

Mr. Grove seconded the resolution. He endorsed what Mrs. Burgwin had said in respect to over-pressure, and especially with regard to what she had said on the needlework question. Mistresses and pupil teachers were ruining their health by taking home work to cut out and fix, and he feared a great deal of what was said to be done by children was really done in part by others. Specimens of this work sent to the Department was the ground upon which the Department went in fixing the work that was to be exacted from the children. Teachers had themselves to thank for several of the most obnoxious regulations of the Code.

After some discussion the resolution was amended and carried. Mr. Greenwood was again elected Treasurer. A long discussion on the Code followed, Mr. Grove expressing his regret that the subject should come on at such a late hour. He moved that the Report be received, which, after some discussion, was carried. Mr. Grove then proceeded to move further resolutions respecting the Code, all of which were carried. Votes of thanks to the Rt. Hon. A. J. Mundella, Miss Mundella, the Mayor, the Master Cutler, and the Inhabitants of Sheffield, were accorded on the motion of Mr. Foster. Mr. Odell moved :—

'That the best thanks of the Conference be given to the various sub-committees of the Local Conference Committee for their excellent and successful arrangements.'

The resolution having been seconded by Mr. Smith, was carried unanimously.

Annual Meetings of the Teachers' Benevolent Fund and the Teachers' Provident Society were held during the week.

EDUCATIONAL EXHIBITION.

The Educational Exhibition in connection with the Conference was held in the Cutler's Hall. The following firms were represented, the books, etc., mentioned, being those to which special prominence is given by the publishers' representatives :—

Messrs. Bemrose and Sons (rep. Mr. Chadwick). New Code Copy Books, College Copy Books, Ruins's Registers, New Ed. Code, Bemrose's Readers, etc.

Messrs. Blackie and Sons (rep. Messrs. Nicol, Smith, and Castell.) Graded Readers, Geographical Readers, Shakspere and Milton Readers for Prospective Code.

Messrs. W. and R. Chambers (rep. Messrs. Durward and McHardy). Graduated Readers, Etymological Dictionary, New Test Cards, Geographical Readers, Elementary Physiography.

Messrs. Fletcher and Co. (rep. Mr. W. Fletcher). Improved Covered Rotary Bicycle, Fleet Double Rotary, etc.

Messrs. Gall and Inglis (rep. Mr. W. R. Mellor). Map of Europe, British Readers, Prize Selections.

Messrs. Gill and Son (rep. Mr. F. Gill). Physiological Diagrams, Historical Readers, Geographical Readers.

Mr. Joseph Hughes (rep. Mr. H. Scheurmier). Educational Works.

Messrs. Isbister and Co. (rep. Messrs. Heller and Skertchley). Natural History Readers, Geographical Readers, Historical and New London Readers.

Messrs. Longmans, Green and Co. (rep. Mr. Greenway). Modern Series, Science Text Books, etc.

Messrs. Moffatt and Paige (rep. Messrs. Cautley and Heasman). Maps. Natural History Charts, etc.

National Society (rep. Messrs. Meech and Burkenshaw). Map of Europe, Physical Geography, Reading Sheets, etc.

Messrs. Nelson and Sons (rep. Messrs. Kenworthy and Gibbs). Historical and Geographical Readers.

North of England School Furnishing Co. (rep. Messrs. Chapman and Glendenning). Comp. Class Register, Slate Boards, Patent Desks.

Mr. H. M. Passley (rep. Mr. A. H. Passley). Cheylesmore Tricycle, Coventry Rotary Bicycle.

Messrs. Redmayne and Co. (rep. Mr. W. May). School Furniture, Improved Hallamshire Desks.

Messrs. Slater (rep. Misses Wilkinson, Hastie, Harrison, Thompson, and Greaves). Griffith and Farran's Publications, Safes, Stoves, Pianos, and Harmoniums.

Messrs. W. Ward and Co. (rep. Mr. Mathew). Certificates, Copy Books, Atlases, etc.

Messrs. Walkington and Broscomb (rep. Mr. Halliday). Paragon Slates, Exercise Books.

Mr. W. Walker. Diagrams, Cabinet of Objects, Wollman's Cards.

Wesleyan Methodist Sunday School Union (rep. Miss Carr). Prize Books, Hymn Books, Sunday Letters, etc., Publications of Palestine Exploration Fund.

We cannot close our report without bestowing a well merited word of praise on the Local Committee, to whose labours the success of the Conference may chiefly be attributed.

THE FROBEL CENTENARY.

ON the evening of Wednesday, April 5th, a large company met in the hall of Stockwell College to celebrate the Centenary of Friedrich Fröbel, who is well known as the founder of that system of training little children which goes by the name of the *Kindergarten*. The large hall of the college had been decorated for the occasion, and on a side-table were exhibited numerous interesting relics of Fröbel: autograph letters and copies of his earliest publications, together with photographs of the places where his life was spent, and a splendidly illuminated album, designed by Miss Kate Ashley, which was intended for transmission to Fröbel's widow.

The proceedings were opened by Mr. W. Woodall, M.P., who pointed out that the Kindergarten was but one feature of the great humanitarian movement of our time, which was so conspicuous in England in the growth of our numerous Sunday-schools. He dwelt on the pathos of Fröbel's early life, when the child recoiled from the drudgery of school life and sought in vain for help to interpret to him the phenomena of nature to which he was irresistibly drawn. A happy accident finally led him to adopt the scholastic profession, and here he met with Pesta-

lozzi, who gave him his life's impulse. His philosophical mind gave Pestalozzi's system that moral and religious tone which it had hitherto lacked, and transformed it from the mere study of natural objects—useful though that was—to a valuable ethical training of the infant mind. Through great opposition Fröbel struggled on and at last saw the institution of the first real *Kindergarten* at Blankenburg. This was in 1850, and two years afterwards the great reformer died at the age of seventy. Speaking then of the increased appreciation of Fröbel's system, Mr. Woodall remarked upon the clause in the new code which insisted on efficient infant teaching and made the grant depend upon the use of improved methods, which could mean nothing else than the practical adoption of Fröbel's system. Our great want was that of trained teachers, and for such there was great scope, for he had seen the Kindergarten system at work under circumstances the most disadvantageous and had never known it to fail of success.

Miss Manning, one of the Vice-president's of the Fröbel Society, then read a letter from Miss Shireff, the President of that Society, regretting that health would not allow her to be present, and congratulating her fellow-workers that they were able to celebrate the centenary with thankfulness for their past success and a good hope for the future. Miss Manning said that she had herself been attracted to Fröbel by his efforts to secure a rightful training for children, where their faculties would have due scope. Fröbel had shown that underneath the apparent wilfulness and naughtiness of children there was a flow of energy and desire for work which only needed proper cultivation to become a valuable factor in future life.

Mr. T. M. Williams, the Chairman of the Committee of the Fröbel Society, thanked the authorities of the college, in the name of the meeting, for their hospitality.

Mr. Woodall then called on Fräulein Heerwart, the highly-esteemed principal of the Stockwell Kindergarten College, who expressed her gratification at meeting so many disciples of Fröbel.

Mr. Langler, the ex-president of the National Union of Elementary Teachers, also expressed his great sympathy with the movement. The formal proceedings which had been agreeably diversified by vocal and instrumental music were terminated by a vote of thanks to the Chairman, moved by the Rev. H. Bourne. The meeting was then transformed into a conversazione, which was brought to a close by an impromptu dance in the tea-room, happily suggested by Fräulein Heerwart.

The programme—a work of art, by the way, and well worthy of the occasion—was designed and printed by Messrs. John Walker and Co.

It is a pleasure to add that the offices of the Fröbel Society are at No. 8, John Street, Adelphi, where all information respecting Kindergarten training may be obtained.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers whose name and address we will gladly give.

Geographical Readers for Elementary Schools. By Charlotte M. Mason. Book II. **The British Empire and the Great Divisions of the Globe.** London: Stanford.

This book is much to our taste. It is readable, and conveys much information in a most pleasant manner, together with a due amount of explanation on the *rationale* of geographical details. Maps are also judiciously referred to, and made the basis of several lessons, instead of being left, as is often the case, to general or accidental use. The most salient points are noticed in a necessarily rapid glance over Europe, and, what is more to the purpose, seldom noticed without judicious explanations. We have now many 'geographies' in which the formerly neglected elucidation of the causes and effects of physical and other influences were neglected. In these the tendency was rather to dwell on the *rationale* of physical geography, and to ignore political details. But these are a welcome relief from mere compilations of names and figures. In the book before us we have these two opposites avoided with the most obviously useful result. In this pleasing way we have the origin of some great physical features indicated. Speaking of the North Sea and its shallowness, the authoress remarks: 'At one time, before "history" began, there were no British isles, and no North Sea; but the continent stretched into the ocean a good way beyond the furthest coast of Ireland.' The low-lying land that extended from the eastern shores of England to Holland—'hollow land'—is supposed to have sunk at the slow rate of a few inches yearly, until the present sunken bed of less than 200 feet in depth was formed, and into which the waters of the Atlantic rushed, and thus formed the shallow sea by which Great Britain was cut off from the Continent. 'In the same way,' the authoress observes, 'the ocean may have rushed into another hollow bed on the west, and so made another sea, cutting off the island which we call Ireland.' The nature and advantages of commerce are thus treated, and also the reasons for the carrying on of mining operations in the northern districts, agriculture in the south, and so on. In an imaginary journey round the British coast, the authoress gives a graphic sketch of the most interesting features, often helping us to understand the meaning of local names, as in the following: 'No cape upon the east coast stands out to sea so boldly as Flamborough Head. A lighthouse rises from its cliffs of white chalk; and upon these cliffs, in ages long gone by, the Danes kept up huge bonfires to light their black ships over the stormy sea. Thus this cape came by its name, the headland of the *flame*.' In this way we might gratify ourselves and, we believe, also our readers by quotations from this well-written book, of whose usefulness we cannot entertain a doubt.

The First Historical Reader. By the Rev. D. Morris. London: Isbister.

Mr. Morris commences with the old fallacies about the Britons: that they were almost savages, did not know how to read and write, or build fine houses; that they lived 'in round huts of wood and mud,' and similar errors that have been so entirely refuted by Nicholas, Pike, Huxley and others as to be discarded by scholars. We are next introduced to Hengist and Horsa, who, we are told, 'seized on Kent and settled there.' This is a rather misleading way of representing the struggle for Kent which was carried on for twenty years before this corner of the country was wrested from the Britons. With all 'history to unlearn' we are not surprised to be told that the Britons 'were forced to find shelter among the mountains in the west of the island, where the English did not come to follow them.' We may, however, follow Mr. Morris with more pleasure through the succeeding chapters of his book, which contain a commendable admixture of leading historical features with a glance at the social condition of the people. The style is altogether commendable in being adapted without apparent effort for young readers. Another useful feature is the well-written summary at the end of each chapter, which, with a few leading dates and a selection of words for spelling exercises, will make the book additionally useful for schools. The illustrations are, besides being remarkably good, numerous and appropriate, and contrast favourably with mere collections of wood-cuts introduced without relevance to the subject-matter. We could have wished for other maps in addition to the useful one opposite to the title-page. The printing, too, is excellent, the type

gratifyingly large, and the paper good. This *First Reader* carries beginners down to the Norman rule under Stephen.

The Second Historical Reader. By the Rev. D. Morris. London: Isbister.

This book carries us down to the days of Elizabeth, and is written on the plan of the First Reader, but in a style suitably advanced to be adapted to the medium school standards. The clear and useful map of early France was to do duty for the entire book, but the other illustrations are as numerous and good as those in the First Reader. Among these we must fairly include a fac-simile specimen of Caxton's printing. This with a well-executed wood-cut of Caxton's Printing Office in Westminster, are valuable helps to the two useful chapters on the introduction of printing into England. Our readers will infer from these remarks that Mr. Morris's book wisely treats of the social matters as well as leading political occurrences. The pretty little view of Mr. Harcourt's islet in the Thames between Wraysbury and Egham is associated with the enforced signature of John to *Magna Charta*, or as our author has it *Magna Carta*. (We suppose we shall next have *Magner Carter*.) But we would rather air our superior learning by scolding little boys into the proper pronunciation of *Charta* than coin a new word for this purpose. *Charter* we know and *Charta* we know, but what is *Carta*? We don't recollect to have met with it in the dialects which Mr. Morris reduces to three as prevalent in England in the Plantagenet times. The leading events of our history from the Normans to the Tudors are told by Mr. Morris with more graphic details and less of the dull compendium of facts that form the staple of most of our school books on history. We are glad to mention in this particular a capital account of the destruction of the 'combined fleets of France and Spain,' as the later phrase has it, by Edward III., who commanded the *Cog Thomas*, and his son the Black Prince. This battle —not half enough recorded—won for Edward the name of King of the Sea, and besides securing England from invasion paved the way for the future maritime efforts of the English. The real difficulty, that of enforcing the laws in former times, is thus well stated by Mr. Morris: —'In those times, however, it was very difficult to get these laws obeyed, and at the end of the reign of Edward III. another Parliament complained that abuses still went on. This Parliament, which met in 1376, tried to improve the government of the king as well as to lessen the power of the [Pope] Bishop of Rome. The House of Commons condemned unjust taxes, and the waste of public money. They insisted that there should be a meeting of Parliament once every year, and that the people should be free to send there the members they liked best, instead of being compelled to send men chosen by the king. And because they tried to bring about so many improvements they were called ever after "The Good Parliament."' Wise words these, temperately expressed, but teem with materials that cannot be otherwise than beneficial in developing thoughtfulness in young readers. For matter of this kind we would willingly sacrifice some of the facts and figures of which most school books are made up. Such judicious remarks—wisely limited as they are in the book before us—are most appropriate in Reading Lessons. While regretting that Mr. Morris has stumbled at the threshold in repeating worn-out errors about the Britons and Saxons, we cannot too highly praise the judgment and care shown in the general narrative.

Geography Reading Books. Part IV. Adapted to Standard V. of the New Code. London: National Society.

In this book the author takes his young readers in a pleasing chatty manner over Europe. After a well-written sketch of the principal water-partings of Europe, the countries of Europe are graphically described under the guise of letters from a French lady to her sister, giving an account of her travels with her sons. Knowledge is not only more readily obtained by this descriptive gossip, but that also of the kind most worthy to be retained. Speaking of the climate of the Douro valleys, the author in the mouth of one of the youthful tourists, says, "How hot it was! Not a breath of wind, and the sun's rays beating into the valley, and coming back to you from the side of the hills." "I don't think it could be hotter in Africa," observed Adolphe. "Right! my young friend," said Mr. Campbell; "I know them both. The summer heat in those valleys on the Douro is tropical. Yet, in winter, you will find—what you will find nowhere else in Portugal—ice thick enough to bear a man." "And this," added M. Santul, "is the secret of the cultivation of the vine. It needs both the winter's cold and the burning heat of summer."'

The illustrations of this book are good, and the wee map of the physical features of Central Europe most useful, because restricted to its professed object. The printing is also good, the binding strong, and the entire 'get up' of the book most commendable.

Lectures on Plants. By Elizabeth Twining. London: William Poole.

The outside of this book gave us hopes. When we read 'Lectures on Plants . . . . . Twining, our thoughts reverted to the early work of Charles Darwin on 'Climbing Plants.' But turning to the perusal of the book we found that it was made up of four common-place lectures on plants by a writer equally ignorant, apparently, of botany and of English.

We do not hesitate to characterize this book as one of the worst we have ever read. The tone of it is most unhealthy, and the way in which religious matters are wantonly dragged into the book, and the glibness with which they are discussed, cannot but shock the mind of every religious person. The 'intentions of the Creator' are spoken of in a way painful to those who believe 'His ways' are 'past finding out' (pages 7, 25). That strange arrogance of humanity that finds expression in such statements as 'all things' in creation being ordered in reference to his (man's) temporal good' (p. 38), is also sadly evident here. Very thoughtless, also, must be an author who can write as Elizabeth Twining writes on p. 26: 'True knowledge of all the best things for man to know, is to be attained by all who desire to learn.' This is the very reverse of the truth. She might as accurately write, 'Food is to be attained by all who are hungry.' There is an intellectual starvation as common in our midst as is, alas! bodily starvation. Hundreds of young men and maidens are hungering and thirsting after knowledge, and from want of time, of opportunity, of money, perhaps of all, never reach it.

The unhappy carelessness of which we shall have to complain in other connections, presently, the writer even extends to her Biblical quotations. 'In the beginning' we are told on p. 41, God 'made the trees and the herbs.' But we read that 'in the beginning God created the heavens and the earth.' Not till the third 'day' after the beginning was a plant made. On p. 26 a still more unpardonable blunder is committed. 'Consider the lilies of the field how they grow,' was advice given to the disciples and other humble friends of the Saviour 'as they walked along.' If the authoress will turn to Matt. vi. 28, she will find the passage she quotes in a certain Sermon on the Mount and at the beginning of that sermon in the fifth chapter she will read: 'And seeing the multitudes He went up into a mountain; and when he was set,' etc.

The style of writing of this little book is deplorable. No young person ought to be allowed to read it, or his grammatical constitution will be undermined. Such slipshod English it has never been our misfortune to read outside the exercises of a composition class. Instances of this loose writing occur on pp. 2, 4, 5, 10 (here is a sentence absolutely destitute of either noun or verb), 11,

12, 14, 16, 23, 27, 29, 34, 42, 49, 97, 68, 69, 72. This is tolerably bad for a book of only eighty-six pages. One or two instances are as follows: On p. 23 we have, 'everything in the world is divided into three *portions:* animal, vegetable, and mineral.' And six pages beyond, the sun's light is in the midst of a dark earth.

More grave almost than these are the botanical blunders. On page 24 we are told that plants 'cannot move themselves from one place to another bodily.' Every botanist knows that the lower plants are constantly performing such a movement of translation. P. 42, 'The only source of anything for a plant is the dark earth in which it grows.' So that the plant takes nothing from the air, and insect-eating plants are unknown! To talk of 'breathing out oxygen' as an act of a plant, in the year 1878, shows a plentiful lack of the most elementary botanical knowledge. We should like to know what evidence the authoress has that stomata are breathing pores. On the same page that she makes the above unfounded assertion (p. 45), she actually writes of 'decomposing the air,' the most outrageous blunder we remember ever to have met with in a book professing to deal with science. The rhizoma or stem of ginger becomes the root. Finally, as far as our patience, not our supply of errors, is concerned, terms used in classification are inextricably concerned, the order Chenopodiaceœ becomes, on p. 70, a class.

We close the review and the book with a sigh of relief that we have seen the last of the latter.

Blackie's Graded Readers. Parts I. and II. Primer, First, Second, Third, Fourth, and Fifth Readers. Edited by Maurice Paterson, B.A. London: Blackie and Son, 49, Old Bailey, E.C.

We have examined this new set of Reading books with care, and we feel, that the highest praise we can give them is to say, that judged from any practical teacher's stand-point they will bear the strictest scrutiny and come well out of the ordeal. As any teacher can have copies upon application to the publishers, it is unnecessary to enter minutely into the contents and merits of each volume. Suffice then, that Mr. Paterson sets out, with what we have always held to be the first aim of an editor, viz., that of making his reading books *interesting*. Unfettered by any special 'method' he presents two bright-looking, attractively illustrated booklets as primers. Little folks will delight to thumb these pleasant books. Of the other volumes we can speak in like terms, they are carefully graduated, not too difficult, and provided with every kind of help either the scholar or teacher could reasonably desire. Clad in the same garb as the 'Comprehensive Readers,' printed in excellent style on good paper —slightly toned to preserve the eyesight—and bound in a style to stand rough school wear, Blackie's Graded Readers should prove favourites wherever adopted.

We give Mr. Paterson a special word of praise for the conscientious way in which he has done his work, and for the healthy and invigorating tone of his reading book.

Maria Wuz, and Lorentz Stark. English Prints of two German Originals. Longmans.

The first of these two life-like sketches concerns, not a woman (as we English might suppose), but a man, the name Maria being epicœne, as in Carl Maria Von Weber and the like. And the simple hero of these pages is but a cheerful, kindly dominie and organist in Auenthal, probably a real character in a true place, whereto the graphic genius of Jean Paul Richter has given immortality by his exquisite word-painting. There is nothing of a plot, and scarcely an incident that could interest a reader; one is reminded in the style of our Goldsmith's 'Vicar of Wakefield,' and of Toppfer's 'Voyages en Zigzag'—all simplicity and cheerfulness, with a subtle vein of humour throughout. We have the climax of the good man's happiness twice over, once in his gladsome wedding, and secondly, at a bound of many intervening years, in his peaceful death. The translation is done by a master hand, and the sketch dedicated very suitably to Thomas Carlyle.

'Herr Lorentz Stark,' by J. J. Engel, is (to tell plain truth) a prolix and prosy record of middle-class German home-life, with far too much detail of uninteresting conversation, and nothing of incident to compensate. The whole story concerns a mild form of quarrel between Herr Stark the elder and his son, because the latter falls in love with a good-looking widow much older than the son, objectionably enough burdened with debts and a couple of ready-made children; which state of domestic affairs is quite enough to enlist a rational reader's sympathy on the old man's side rather than his son's; but this is not the result intended by the author. Clearly J. J. Engel is not to be compared, as a word-painter, with J. P. Richter.

Philip's Series of Map-Drawing Books. No. 2 England and Wales, No. 22 Australia. With Instructions. By J. Francon Williams, F.R.G.S. London: Geo. Philip and Son, Fleet Street.

Mr. Williams has done a good service in publishing this series of Map-Drawing Books. Each book contains (1) a complete Full-Coloured Map, so attached as to be always available for copying; (2) an Uncoloured Map without the names, which the pupil can fill in as an introductory exercise; (3) an Outline Map, with coast-line and lines of latitude and longitude only—the pupil being required to fill in the mountains, rivers, towns, etc., with the names; (4) Map with lines of latitude and longitude only; (5) a blank sheet, with border of Map only. They will prove invaluable to the young learners, and are well worthy the consideration of every teacher of 'Mapping.' The books are issued in two sizes at threepence and sixpence each.

Cassell's Book of Sports. Part I. London: Cassell, Petter, Galpin and Co.

This is a new serial of the famous firm in La Belle Sauvage Yard. It fully maintains the reputation of the house, and is sure to be widely read. The printing has been done in splendid style.

Preparations for Science Teaching. By John Spanton. London. Griffith and Farran.

The former part of this book is so excessively simple and prolix in dialogues on the common properties of matter that teachers who are worth their salt will skip or laugh at the first half of the book. The latter part is, however, open to no such objection. The author warms to his work, gives good explanations, and capital suggestions for lessons. The lists of objects recommended to be provided for each lesson will also be serviceable. The lessons on the Senses will also be valued. The list of books recommended at the end 'may be of service,' as the author says, if 'beginners' could command some twenty years to master them. Such lists are too extensive to be of practical value.

The Bicycle Road Book. By Charles Spencer. London: Griffith and Farran.

This is a new and revised Edition (with Map) of a book which we commended to our readers nearly a year ago. We can now only endorse our former good opinion of the work, which is issued at a shilling,—half the original price.

Thrift.—No. 1. London: National Thrift Society.

We hail the appearance of this excellent periodical with pleasure. It is calculated to do much towards the cultivation of habits of thrift and economy, and has our heartiest wishes for its success.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. IVANHOE.—$\frac{1}{17} = \cdot 05882\frac{6}{17}$; carry out to 20 places by multiplication.

$\frac{1}{17} = \cdot 05882\frac{6}{17}$,

$\therefore \frac{6}{17} = \cdot 05882\frac{6}{17} \times 6$

$= \cdot 35294\frac{12}{17}$;

$\frac{2}{17} = \cdot 05882\frac{6}{17} \times 2$

$= \cdot 11764\frac{12}{17}$;

$\frac{12}{17} = \cdot 35294\frac{12}{17} \times 2$

$= \cdot 70588\frac{12}{17}$.

$\therefore \frac{1}{17}$ to 20 places $= \cdot 05882352941176470588$.

2. YELSERP.—A and B set out from the same place in the same direction. A travels uniformly 18 miles per day, and after 9 days turns and goes back as far as B has travelled during those 9 days; he then turns again, and pursuing his journey, overtakes B at the end of $22\frac{1}{2}$ days after the time they first set out. Show that B uniformly travelled 10 miles a day. (*Barnard Smith.*)

A can walk in $22\frac{1}{2}$ days as far as B can walk in

$\{22\frac{1}{2} + (9 \times 2)\}$ days, or $40\frac{1}{2}$ days;

$\therefore$ B's rate per day $= \frac{18 \times 22\frac{1}{2}}{40\frac{1}{2}}$ miles

$= \frac{{}^{2}\!\not{18} \times {}^{5}\!\not{45}}{\not{81}}$ "

$= 10$ miles.

3. ROSEBUD.—If a snail, on the average, creep 2 ft. 7 in. up a pole during 12 hours in the night, and slip down 16 in. during the 12 hours in the day, how many hours will he be in getting to the top of a pole 35 ft. high? (*Barnard Smith.*)

The snail advances at the rate of (2 ft. 7 in. − 16 in.), or 15 in. in every 24 hours, except the part left after the last day.

35 ft. ÷ 15 in. = 35 ft. ÷ $1\frac{1}{4}$ ft. = 28.

As the snail creeps up 31 in. during the night, 30 in. remain after 26 days.

Time to creep up the last 30 in. $= \frac{30}{31}$ of 12 hours

$= \frac{360}{31}$ hours

$= 11\frac{19}{31}$ hours.

$\therefore$ Total time = 26 days $11\frac{19}{31}$ hrs.

$= 635\frac{19}{31}$ hours. Ans.

4. R. B.—A shopkeeper buys $\frac{1}{2}$ cwt. of tea at 4s. 2d. per lb., and mixes it with tea which cost him 2s. 11d. per lb. How much of the latter must he add to the former, that he may sell the mixture at 3s. 8d. per lb., and gain 20 per cent. on his outlay? *Barnard Smith.*)

Cost price of mixture per lb. $= 3\text{s. } 8\text{d.} \times \frac{120}{100}$

$= \frac{6}{5}$ of 3s. 8d.

$= 3\text{s. } 0\frac{4}{5}\text{d.}$

Difference between cost price of mixture and first kind

$= 4\text{s. } 2\text{d.} - 3\text{s. } 0\frac{4}{5}\text{d.}$

$= 1\text{s. } 1\frac{1}{5}\text{d.}$

$= 13\frac{1}{5}\text{d.}$

" " " " " second kind

$= 3\text{s. } 0\frac{4}{5}\text{d.} - 2\text{s. } 11\text{d.}$

$= 1\frac{4}{5}\text{d.}$

$\therefore$ Quantity of 1st kind : Quantity of 2nd kind $:: 1\frac{4}{5} : 13\frac{1}{5}$

$:: 5 : 40$

$:: 1 : 8$

$\therefore$ Quantity at 2s. 11s. $= \frac{1}{2}$ cwt. $\times 8 = 4$ cwt. Ans.

5. J. YOUNG.—I sold out of the 3 per cents. at 96, and invested the sum accruing in railway 5 per cent. stock, thereby increasing my income 50 per cent. What was the price of the railway stock?

£3 + 50% of £3 = £4½.

$\therefore$ Price of railway stock $= £96 \times \frac{5}{4\frac{1}{2}}$

$= \frac{200}{9}$ £

$= £106\frac{8}{9}$. Ans.

6. ST. BLOATER.—Any number of men can dig 20 feet (in length) of trench for the foundation of a wall, or build 9 feet (in length) of the wall, or fill up 85 feet of the trench after the wall is built, in a day of 10 hours. Find how many out of 1058 men must be employed day by day in building the wall, so that the remaining men may be just sufficient each day to dig for the next day's building, and to fill up after the preceding day's building the same length of trench.

To dig 1 foot $\frac{1}{20}$ (in proportion) of the men are required.

" build " $\frac{1}{9}$ " " " " "

" fill up " $\frac{1}{85}$ " " " " "

$\frac{1}{9} + \frac{1}{20} + \frac{1}{85} = \frac{340 + 153 + 36}{3060} = \frac{529}{3060}$

$\therefore$ There must be employed to build $\frac{340}{529}$ of 1058 men.

$= 680$ men. Ans.

7. MAGISTER.—The interest on a sum at simple interest is £7, and the discount for the same time is £5 9s. 4½d. What is the sum?

Let S = Sum
R = Rate per cent.
I = Interest
D = Discount.

$$\left.\begin{aligned}\text{Then } I &= S \times \frac{R}{100}\\ D &= S \times \frac{R}{100+R}\end{aligned}\right\}$$

$$\left.\begin{aligned}I \times \frac{100}{R} &= S\\ D \times \frac{100+R}{R} &= S\end{aligned}\right\}$$

$$\therefore I \times \frac{100}{R} = D \times \frac{100+R}{R}$$

$$I \times 100 = D \times (100+R)$$

$$I \times 100 = (D \times 100) + (D \times R)$$

$$(I \times 100) - (D \times 100) = D \times R$$

$$(I - D) \times 100 = D \times R.$$

$$\therefore (£7 - £5\ 9s.\ 4\tfrac{1}{2}d.) \times 100 = £5\ 9s.\ 4\tfrac{1}{2}d. \times R$$

$$(£7 - £5\tfrac{1}{8}\tfrac{8}{8}) \times 100 = £5\tfrac{1}{8}\tfrac{8}{8} \times R$$

$$£1\tfrac{1}{8}\tfrac{7}{8} \times 100 = £5\tfrac{1}{8}\tfrac{8}{8} \times R$$

$$£\tfrac{4900}{88} = £\tfrac{175}{88} \times R$$

$$4900 = 175 \times R$$

$$\therefore R = \tfrac{4900}{175}$$

$$= 28.$$

$$S = I \times \frac{100}{R}$$

$$= £7 \times \frac{100}{28}$$

$$= £25.$$

$\therefore$ Sum = £25. Ans.

8. C. S. E.—A rectangular tank is 37 ft. 5 in. 6 pts. long, 22 ft. 7 in. 8 pts. wide, and has a volume of 329 cub. yds. 21 ft. 273 in. Find by duodecimals the depth of the tank. (*Civil Service Exam.*, Nov., 1881.)

ft.			
37	5′	6″	
22	7	8	
824	1	0	
21	10	2	6‴
2	0	11	8
sq. ft. 848	0	2	2

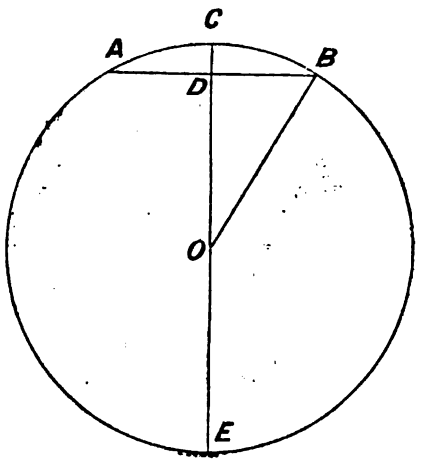
329 cub. yds. 21 ft. 273 in. = 8,904 cub. ft. 273 in.
= 8,904 cub. ft. 1′ 10″ 9‴

12	273
12	22 9
	1′ 10″ 9‴

sq. ft.	cub. ft.			
843	0′ 2″ 2‴)	8904	1′ 10″ 9‴	(10½ ft.
		8480	1′ 9 8	
		424	0 1 1	

$\therefore$ Depth of tank = 10½ ft. Ans.

9. ARETHUSA.—In a certain lake the tip of a bud of lotus was seen a span above the surface of the water. Forced by the wind, it gradualllly advanced, and was submerged at a distance of two cubits. Compute the depth of the water.—(*Barnard Smith.*)



Let AB represent the surface of the water, and OC the lotus; then at B the lotus is submerged.

CD = a span = 9 in.; DB = 2 cubits = 36 in.

First Method—

AD = DB = 36 in.

CD × DE = AD × DB (Euclid, III. 35)

9 in. × DE = 36 in. × 36 in.

$\therefore$ DE = 144 in.

CE = CD + DE = (9 + 144) in. = 153 in.

OC = ½ of CE = ½ of 153 in. = 76½ in.

$\therefore$ Depth of water (OD) = (76½ − 9) in.
= 67½ in.
= 5 ft. 7½ in. Ans.

Second Method—

$OB^2 = OD^2 + DB^2$ (Euclid, I. 47)
$= (OC - CD)^2 + DB^2$
$= (OB - 9)^2 + 36^2$
$= OB^2 - 18\ OB + 81 + 1296$

$18\ OB = 1377$

$\therefore OB = 76\tfrac{1}{2}$ in.

OD = OB − CD = (76½ − 9) in. = 67½ in. = 5 ft. 7½ in.
(Depth of water.)

10. G. JUMBO.—A cistern has 3 pipes, A, B, and C; A and B can fill it in 3 and 4 hours respectively, and C can empty it in 1 hour. If these pipes be opened in order at 3, 4, and 5 o'clock, when will the cistern be empty? (*Barnard Smith.*)

A can fill the cistern in 3 hours,
B " " " 4 "
C " empty " " 1 hour;

$\therefore$ At 4 o'clock ¼ of the cistern is filled;
" 5 " ¾ + ¼ or 1½ of the cistern is filled.

Part emptied in 1 hour when all the pipes are open
$= 1 - (\tfrac{1}{3} + \tfrac{1}{4}) = 1 - \tfrac{7}{12} = \tfrac{5}{12}$;

$\therefore$ Time to empty the cistern = $(1\tfrac{1}{2} \div \tfrac{5}{12})$ hours.
= 1⅕ hours.
= 2 hrs. 12 min.

$\therefore$ The cistern will be empty at 12 min. past 7.

11. GLACIER.—Given that the square root of 105,625 is 325, find that of 10,582,009, without going through the ordinary, operation of finding the square root. (*Barnard Smith.*)

$325^2 = 105,625$,

$\therefore 3,250^2 = 10,562,500$;

10,582,009 − 10,562,500 = 19,509;

19,509 ÷ (3,250 × 2)
= 19,509 ÷ 6,500
= $3 + \tfrac{9}{6500}$. (As the remainder (9) is the square of the quotient (3), it is an exact square.)

$\therefore$ Square root of 10,582,009 = 3,253.

12. CYMRO.—Arrange the digits 58,967,537 so that the number formed may be divisible by 19. (Scholarship Examination, 1880.)

Arrange the digits in pairs, divisible by 19.

Thus:—

58,967,537
57,896,753 (First pair divisible by 19).
57,389,675 (First and second pairs divisible by 19).
57,389,567 (First, second, and third pairs divisible by 19).
57,389,576 (Number divisible by 19).

13. SEDGEMOOR.—A person mixes 119 lbs. of coffee with 51 lbs. of chicory, the ratio of their values being as 1 : ⅓. By selling the mixture at 1s. 9d. per lb., he gains 5 per cent. Required the cost price of the coffee and chicory per lb.

Cost price of mixture per lb. = $\tfrac{100}{105}$ of 1s. 9d.
= $\tfrac{20}{21}$ of 1s. 9d.
= 20d.

Cost price of (119 + 51) or 170 lbs. of mixture.
= (170 × 20)d.
= 3400d.

Cost price of 119 lbs. of coffee + cost price of 51 lbs. of chicory = 3400d.

$\therefore$ Cost price of (119 × 7) lbs. of chicory + cost price of 51 lbs. of chicory = 3400d.

Cost price of (833 + 51) lbs. of chicory = 3400d.
" " " 884 lbs. " = "
$\therefore$ Cost price of chicory per lb. = $\tfrac{3400}{884}$d.
= $3\tfrac{4}{13}$d. $\tfrac{8}{13}$q.

And cost price of coffee per lb. = $3\tfrac{4}{13}$d. $\tfrac{5}{13}$q. × 7.
= 2s. $2\tfrac{3}{13}$d. $\tfrac{9}{13}$q.

14. ALPHA, Tring.—A person buys tea at 6s. a lb., and also some at 4s. In what proportions must he mix them, so that selling his tea at 5s. 3d. a lb., he may gain 20 per cent. on each lb. sold?

Cost price of mixture per lb. $= \frac{100}{120}$ of 5s. 3d.

$= \left(\frac{5}{6} \text{ of } \frac{21}{4}\right)$s.

$= 4\frac{3}{8}$s.

Difference in price between mixture and first kind $= 6\text{s.} - 4\frac{3}{8}\text{s.} = 1\frac{5}{8}\text{s.}$

" " " " second " $= 4\frac{3}{8}\text{s.} - 4\text{s.} = \frac{3}{8}\text{s.}$

∴ Quantity of 1st kind : Quantity of 2nd kind $:: \frac{3}{8} : 1\frac{5}{8} :: 3 : 13.$

15. ALPHA, Carlisle.—£25 0s. 8d. was collected after a sermon; the bags contained a certain number of sovereigns, twice as many half-sovereigns, six times as many crowns, nine times as many half-crowns, twenty times as many shillings, and the number of fourpenny pieces was equal to the number of all the rest of the coins. What number of half-crowns did the bag contain?

		£	s.	d.
Suppose the No. of sovereigns	= 1, then value =	1	0	0
Then " " half-sovereigns	= 2, and " =	1	0	0
" " " crowns	= 6, " " =	1	10	0
" " " half-crowns	= 9, " " =	1	2	6
" " " shillings	= 20, " " =	1	0	0
" " " fourpences	= 38, " " =	0	12	8
		£6	5	2

£ s. d. £ s. d. Half-crowns.

∴ 6 5 2 : 25 0 8 :: 9 : No. of half-crowns.

∴ No. of half-crowns $= 9 \times 4$

$= 36.$ Ans.

16. QUÆSITOR.—Suppose 5 candidates are examined for two scholarships, and that A obtains $\frac{2}{3}$ of the whole number of marks given; B twice as many as A gets more than C, who obtains 3 times as many as B gets more than D; that D obtains $\frac{1}{2}$ as many as B, and C together, and E $\frac{1}{3}$ more than the excess of the sum of A, B, and C's marks over D's. Determine the successful candidates.

Let the letters representing the candidates stand for the fraction of the whole number of marks obtained by them, respectively.

$A = \frac{2}{3}$

$B = 2(A - C)$

$C = 3(B - D)$

$D = \frac{1}{2}(A + B + C)$

$E = \frac{1}{3}(A + B + C - D)$

$E = \frac{1}{3}(2D - D)$

$= \frac{1}{3}D.$

$B = 2(A - C)$

$= 2(\frac{2}{3} - C)$

$= \frac{4}{3} - 2C.$

$C = 3(B - D)$

$= 3(\frac{4}{5} - 2C - D)$

$= \frac{12}{5} - 6C - 3D$

$7C = \frac{12}{5} - 3D$

$\therefore C = \frac{12}{35} - \frac{3}{7}D.$

$D = \frac{1}{2}(A + B + C)$

$= \frac{1}{2}(\frac{2}{3} + \frac{4}{5} - 2C + C)$

$= \frac{1}{2}(\frac{6}{5} - C)$

$= \frac{1}{2}\{\frac{6}{5} - (\frac{12}{35} - \frac{3}{7}D)\}$

$= \frac{1}{2}\{\frac{18}{35} - \frac{12}{35} + \frac{3}{7}D\}$

$= \frac{1}{2}(\frac{6}{7} + \frac{3}{7}D)$

$= \frac{3}{7} + \frac{3}{14}D$

$D - \frac{3}{14}D = \frac{3}{7}$

$\frac{11}{14}D = \frac{3}{7}$

$\therefore D = \frac{3}{7} \times \frac{14}{11} = \frac{6}{11}.$

$C = \frac{12}{35} - \frac{3}{7}D$

$= \frac{12}{35} - \frac{3}{7}$ of $\frac{6}{11}$

$= \frac{12}{35} - \frac{18}{77}$

$= \frac{132 - 90}{385}$

$= \frac{42}{385}$

$= \frac{6}{55}.$

$B = \frac{4}{5} - 2C$

$= \frac{4}{5} - \frac{12}{55}$

$= \frac{44 - 12}{55}$

$= \frac{32}{55}$

$E = \frac{1}{3}D$

$= \frac{2}{3}$ of $\frac{6}{11}$

$= \frac{4}{11}.$

The number of marks obtained by the candidates $= \frac{2}{3}, \frac{32}{55}, \frac{6}{55}, \frac{6}{11}, \frac{4}{11}$, respectively, of the whole number of marks.

∴ The successful candidates are B and E.

Algebra.

1. J. T. BROWN.—A number consists of two digits; their sum is 13, and their product is 34 less than the number. What is that number?

Let x = digit in tens' place,

And y = " " units' " ;

Then $10x + y$ = the No.

∴ (1) $x + y = 13$

(2) $xy + 34 = 10x + y$

(1) $x + y = 13$

$\therefore y = 13 - x.$

(2) $(13 - x)x + 34 = 10x + 13 - x$

$13x - x^2 + 34 = 9x + 13$

$-x^2 + 13x - 9x = 13 - 34$

$x^2 - 4x = 21$

$x^2 - 4x + (2)^2 = 21 + 4$

$= 25$

$x - 2 = \pm 5$

$\therefore x = 7$ $\quad y = 13 - x = 6$

∴ No. = 76.

2. NIL DESPERANDUM.—The product of two numbers equal 6 times their sum, and the sum of their squares is 325. Find the numbers.

Let x = one No.,

And y = the other;

Then, (1) $xy = 6(x + y)$

(2) $x^2 + y^2 = 325$

(1) $xy = 6(x + y)$

Squaring, $x^2y^2 = 36(x + y)^2$

$= 36(x^2 + 2xy + y^2)$

$= 36(2xy + x^2 + y^2)$

$= 36(2xy + 325)$ $\quad \{x^2 + y^2 = 325\ (2)\}$

$= 72xy + 11{,}700$

$x^2y^2 - 72xy = 11{,}700$

$x^2y^2 - 72xy + (36)^2 = 11{,}700 + 1{,}296$

$= 12{,}996$

$xy - 36 = \pm 114$

$xy = \pm 114 + 36$

$\therefore xy = 150.$

(1) $150 = 6(x + y)$

$\therefore x + y = 25.$

(2) $x^2 + y^2 = 325$

$2xy = 300$

$x^2 - 2xy + y^2 = 25$

$\therefore x - y = 5$

$x + y = 25$

$2x = 30$

$\therefore x = 15,$ and $y = 10.$

∴ The numbers are 15 and 10.

3. BEAN-STALK.—Solve— $\frac{x - 7}{5} + \frac{x + 1}{11} = \frac{2x - 7}{3} - 11.$

$\frac{x - 7}{5} + \frac{x + 1}{11} = \frac{2x - 7}{3} - 11.$

L. C. M. = 165

$33(x - 7) + 15(x + 1) = 55(2x - 7) - (155 \times 11)$

$33x - 231 + 15x + 15 = 110x - 385 - 1{,}815$

$33x + 15x - 110x = 231 - 385 - 1{,}815$

$48x - 110x = 231 - 2{,}215$

$-62x = -1{,}984$

$\therefore x = 32$

4. ALGEBRA, Enfield.—Find two consecutive numbers such that the half and the fifth of the first taken together shall be equal to the third and fourth of the second taken together. (*Todhunter.*)

Let x = first number,
Then $x+1$ = second ,,

$$\therefore \frac{x}{2}+\frac{x}{5}=\frac{x+1}{3}+\frac{x+1}{4}$$
$$\frac{7x}{10}=\frac{7(x+1)}{12}$$
$$\frac{x}{10}=\frac{x+1}{12}$$
$$6x=5x+5$$
$$\therefore x=5$$

$\therefore$ Nos. are 5 and 6.

5. SCHOLARSHIP.—A and B start to run a race: at the end of 5 minutes, when A has run 900 yards, and has outstripped B 75 yards, he falls; but though he loses ground by the accident, and for the rest of the course makes 20 yards a minute less than before, he comes in only half a minute behind B. How long did the race last?

A runs 900 yds. in 5 min., and outstrips B by 75 yds.;
$\therefore$ B runs 825 yds. in 5 min.
$\therefore$ B ,, 160 ,, per min.,
And A ,, 180 ,, ,, before accident.
Let x = time race lasted in minutes,
Then $165x$ = length of course in yards.
A runs 165 yds. per min. after accident,
And $165x-900$ = No. of yds. A has to run after accident;
Then $\frac{165x-900}{160}$ = time it takes him.

$$\therefore \frac{165x-900}{160}=x-4\tfrac{1}{2}$$
$$165x-900=160x-720$$
$$165x-160x=900-720$$
$$5x=180$$
$$\therefore x=36$$

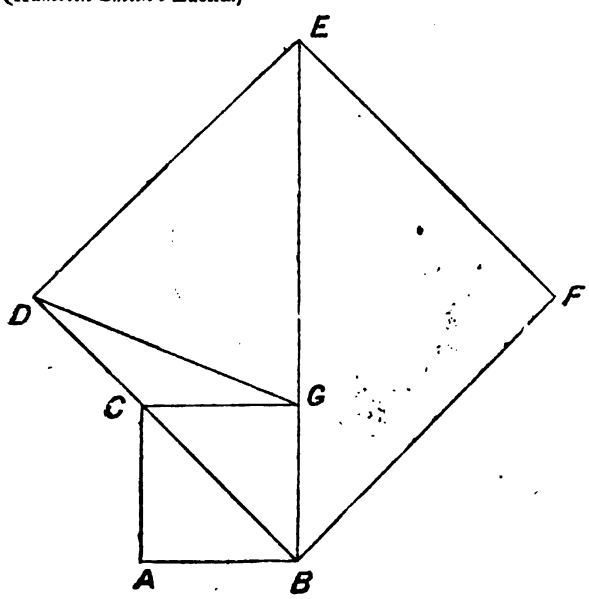
$\therefore$ Race lasted 36 minutes.

6. MATHEMATICUS.—Three flags are required to make a signal. How many signals can be given by 20 flags of 5 different colours, there being 4 of each colour?

No. of signals with 1 of a colour $= 5 \cdot 4 \cdot 3 = 60$;
,, ,, ,, 2 ,, $= 3 \cdot 4 \cdot 5$. (Two of one colour with one of the others will make 3 signals).
$= 60$;
,, ,, ,, 3 ,, $= 5$;
$\therefore$ No. of signals $= 60+60+5$
$= 125$. Ans.

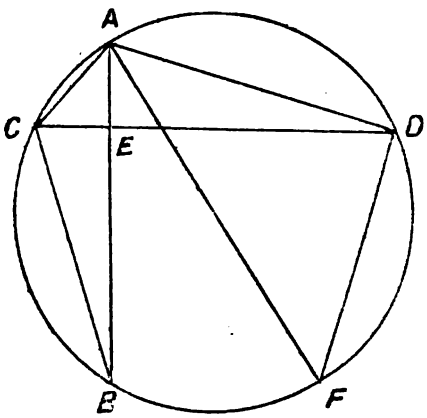
Geometry.

1. NORMAN.—Show how to describe a square, the difference between the lengths of a diagonal and a side being given. (*Hamblin Smith's* Euclid.)



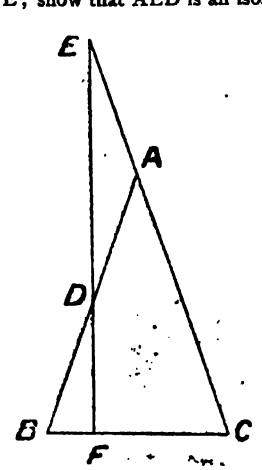
Let AB be the given difference.
Construction.—At A erect perpendicular AC = AB.
Join BC, and produce it to D, making CD = AB.
Then DB shall be the side of the required square.
Proof.—Construct the square DEFB. Join EB, and from C draw CG perpendicular to EB. Join DG.
AB = AC, $\therefore$ $\angle$ ABC = $\frac{1}{2}$ right angle;
$\angle$ GBC = $\frac{1}{2}$ right angle; $\therefore$ $\angle$ ABG is a right angle: wherefore ABGC is a square.
CG = AB, and CD = AB (con.), $\therefore$ CD = CG (ax. 1); wherefore $\angle$ CDG = $\angle$ CGD (i. 5).
$\angle$ CDE = $\angle$ CGE = (ax. 11), $\therefore$ $\angle$ EDG = $\angle$ EGD (ax. 3); $\therefore$ ED = EG (i. 6).
Where BG, that is AB, is the difference between a diagonal, and a side of the square DEFB. Q. E. F.

2. T. B., Liverpool.—If two chords of a circle intersect at right angles, the sum of the squares on the four segments equals the square on the diameter.



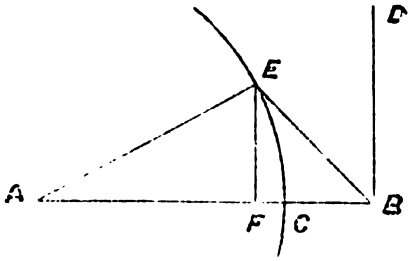
Let the chords AB, CD, intersect at right angles in E.
Then $AE^2 + EB^2 + CE^2 + ED^2$ = square on the diameter.
Draw the diameter AF, and join AC, AD, BC, DF.
Proof.—$\angle$ ADF is a right angle (III. 31), and therefore equal to the $\angle$ AEC; also $\angle$ ACE = $\angle$ AFD (III. 21);
$\therefore$ $\angle$ CAB = $\angle$ DAF (I. 32);
wherefore arc CB = arc DF (III. 26),
and therefore chord CB = chord DF. (III. 29.)
$AD^2 = AE^2 + ED^2$ (I. 47),
and $CB^2 = CE^2 + EB^2$;
$\therefore$ $AD^2 + CB^2 = AE^2 + ED^2 + CE^2 + EB^2$ (ax. 2);
but DF = CB, and $AF^2 = AD^2 + DF^2$;
$\therefore$ $AF^2 = AE^2 + EB^2 + CE^2 + ED^2$.
When the chords meet without the circle, the property is proved in a similar manner. Q. E. D.
Note.—Writing fair, but rather too thick. It would pass at the Scholarship Examination.

3. ALASCO.—The straight line EDF, drawn at right angles to BC the base of an isosceles triangle, cuts the side AB in D, and CA produced in E; show that AED is an isosceles triangle.



Proof.—In the triangles EFC, DFB,
∠EFC = ∠EFB, (ax. 11,)
and ∠ECF = ∠DBF, (I. 5,)
∴ ∠CEF = ∠BDF, (I. 32.)
but ∠ADE = ∠BDF, (I. 15,)
∴ ∠AED = ADE, (ax. 1,)
wherefore the triangle AED is isosceles. (I. 6). Q. E. D.

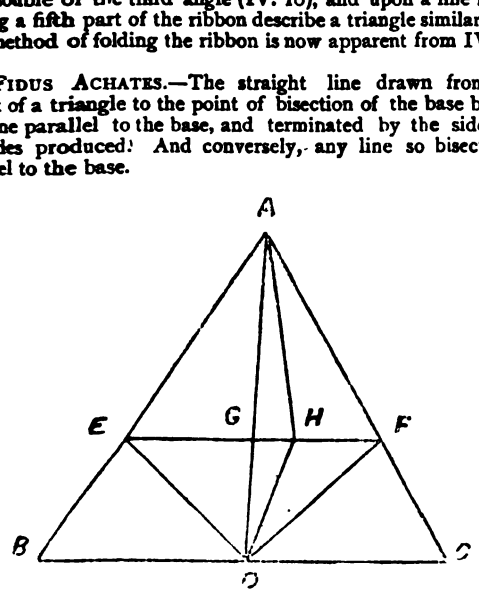
4. E. BRERETON.—Construct a right-angled triangle, having given the hypotenuse and the sum of the sides (*Todhunter's* Euclid).



Let AB be the sum of the sides, and AC the length of the hypotenuse.
At the point B erect perpendicular BD.
Bisect angle ABD by the straight line BE.
From the centre A, at the distance AC, describe an arc cutting BE in E.
Draw EF perpendicular to AB.
Then AEF shall be the triangle required.
Proof.— ∠EFB is a rt. ang., and ∠FBE is ½ rt. ang.,
∴ ∠FEB is ½ rt. ang.; (I. 32).
wherefore FE = FB (I. 6).
∴ AE, EF are together equal to AB, and AE = AC;
also ∠AFE is a rt. ang.
Q. E. F.

5. ECCLES.—A watch-ribbon is folded up into a flat knot of five edges; show that the sides of the knot form a regular pentagon.—(*Potts'* 'Euclid.')
Describe an isosceles triangle having each of the angles at the base double of the third angle (IV. 10), and upon a line representing a fifth part of the ribbon describe a triangle similar to it. The method of folding the ribbon is now apparent from IV. 11.

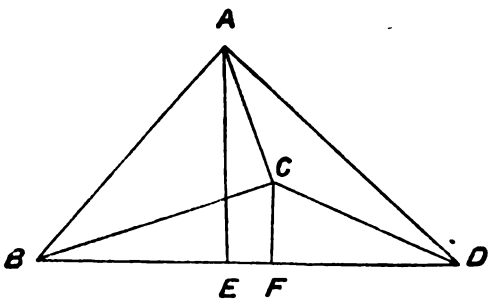
6. FIDUS ACHATES.—The straight line drawn from the vertex of a triangle to the point of bisection of the base bisects any line parallel to the base, and terminated by the sides, or the sides produced. And conversely, any line so bisected is parallel to the base.



In the triangle ABC, let the straight line AD bisect the base BC.
Draw EF parallel to BC, and cutting AD in G.
Then EF shall be bisected in G.
Join DE, DF.
Proof—△BAD = △CAD, (I. 36)
and △BED = △CFD, ,,
△ADE = △ADF (ax. 3).
If EF be not bisected in G, if possible let it be bisected in H, HD
Then △AHE = △AHF,
And △EHD = △FHD;
Wherefore quadrilateral AHDE is half the quadrilateral AEDF;
But the triangle ADE is half the quadrilateral AEDF;
Therefore ADE is equal to AHDE, which is absurd.
Wherefore EF must be bisected in G.
When the line is drawn parallel to the base and terminated by the sides produced, it is proved in a similar manner.
Conversely—Let AD bisect EF, BC.
Tnen EF shall be parallel to BC.
Proof.—△BAD = △CAD, (I. 36)
△EGA = △FGA, ,,
and △EGD = △FGD; ,,
∴ △BED = △CFD; (ax. 3).
Wherefore EF is parallel to BC (I. 40).
Similarly when the line is terminated by the sides produced.
Q. E. D.

Mensuration.

1. IKY MO.—One diagonal of a quadrilateral which lies outside the figure is 70 ft., and the difference of the perpendiculars upon it from the extremities of the other diagonal is 16 ft. Find the area.



$$\text{Area of } \triangle ABD = \frac{BD \times AE}{2},$$

$$\text{,, } \triangle CBD = \frac{BD \times CF}{2};$$

$$\therefore \text{ Area of quadrilateral } ABCD = \frac{BD \times AE}{2} - \frac{BD \times CF}{2}$$

$$= \frac{70 \times AE}{2} - \frac{70 \times CF}{2}$$

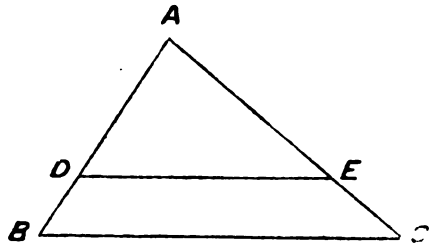
$$= 35 \times AE - 35 \times CF$$

$$= 35\,(AE - CF)$$

$$= 35 \times 16$$

$$= 560 \text{ sq. ft.}$$

2. NIL DESPERANDUM.—A person has a triangular-shaped garden, the base of which contains 200 yards, and divides it into two equal parts by a hedge parallel to the base; find the length of the hedge.—*Todhunter's* 'Mensuration.'



△ADE : △ABC :: DE² : BC² (Euclid, VI. 19)
∴ 1 : 2 :: DE² : 200²
2DE² = 40,000
DE² = 20,000
∴ DE = $\sqrt{20{,}000}$
= 141·42...
∴ Length of hedge = 141·42 ..yds.

3. J. S. E. N., Shatto Heath.—If the perimeter of a semicircular flower-bed be 60 feet, how many plants will it contain

Diameter + ½ Circumference = 60 ft.
Diameter + (½ Diameter × 3·1416) = 60 ft.
Diameter + (Diameter × 1·5708) = 60 ft.
Diameter × 2·5708 = 60 ft.

$$\therefore \text{Diameter} = \frac{60}{2{\cdot}5708}\text{ft.} = \frac{15}{{\cdot}6427}\text{ft.}$$

$$\text{Area of flower-bed} = \tfrac{1}{2}\{(\tfrac{15}{{\cdot}6427}\text{ ft.})^2 \times {\cdot}7854\} = \frac{225 \times {\cdot}3927}{{\cdot}41306329}\text{sq. ft.} = \frac{88{\cdot}3575}{{\cdot}41306329}\text{ sq. ft.} = 213\frac{37,501,923}{41,306,329}\text{sq. ft.}$$

∴ No. of plants = 213.

4. N. G. R.—The solid content of a sphere being ⅞ of $\frac{22}{21}$ of a cube, the side of which is the radius of the sphere, and a cubic foot of iron weighing 450 lbs., find the diameter of a 68 lb. cannon ball.

Solidity of cannon ball = $\frac{68}{450}$ cub. ft. = $\frac{34}{225}$ cub. ft.

Radius " " = $\sqrt[3]{\left(\frac{7}{8}\text{ of }\frac{11}{21}\text{ of }\frac{17}{75}\right)\text{cub. ft.}}$

$$= \sqrt[3]{\frac{1921}{53250}\text{ cub. ft.}}$$

Diameter " " $= 2\sqrt[3]{\frac{1921}{53250}}$ cub. ft.

$$= \sqrt[3]{\frac{1921 \times 8}{53250}}\text{ cub. ft}$$

$$= \sqrt[3]{\frac{7684}{26625}}\text{ cub. ft.}$$

$$= \sqrt[3]{{\cdot}288600\ldots}\text{cub ft.}$$

$$= {\cdot}66\ldots\text{ft.}$$

$$= 7{\cdot}92\ldots\text{in. Ans.}$$

General.

1. T. D.—Your query is solved in our last issue. See Pupil Teachers' Examination Questions, p. 93.

2. ANXIOUS ENQUIRER, W. H. S. B.—See replies to Nos. 25 and 26 in February part.

3. MARY.—(1st year.) To write from memory the substance of a passage of simple prose, read to them with ordinary quickness, or a short letter.

(2nd year.) To write full notes of a lesson on a subject selected by the inspector.

(3rd year.) To write a letter, or to write from memory the substance of a longer passage than at the end of first year.

(4th year.) To write an original composition on some simple subject selected by Her Majesty's Inspector.

4. E. P. T., Littlehampton.—We are obliged by your offer, and regret that we cannot accept it at present.

5. STICK-IN-THE-MUD.—You will find the solution of your problem in the March No., page 41.

6. A. SLOPER.—It is advisable to put a column for method in writing Notes of Lessons on *any* subject.

7. JUNIOR.—Under the old code pupil teachers must be bound for *two* years *at least*.

8. J. H., Orkney.—10s. 6d. Post free for published price.

9. W. H.—(1) No. (2) The Historical Books.

10. X. Y. Z., Hasland.—The Treaty of Wedmore was concluded between Alfred and the Danes. By its terms a large part of the land was given to the Danes for a settlement.

11. GRAMMARIAN.—Angus or Morris.

12. CETEWAYO.—Scripture Questions are not set at the Scholarship Examination by the Department, but by the authorities of the different denominational colleges.

13. SAIS.—See the previous numbers of this Journal for information.

14. ST. HELENA.—'How to Compose and Write Letters' (*Hughes*), 1s.

15. SOLWAY.—The solution you send is quite correct.

16. W. R.—We cannot see the method of solution of your query.

17. J. P. R., Glasgow.—I certainly think you have a very fair chance of success if you work. Todhunter's books are the ones generally used, but those by Deschanel, Ganot, and Balfour Stewart are also likely to prove useful.

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Wisdom is humble that he knows no more.'—COWPER.

VOL. II. No. 4. JUNE, 1882. PRICE 6D. POST FREE, 7½D.

School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

IV.

WOUNDS—(*continued*).

IF there is a suspicion that a particular wound is a poisoned wound, the possibility of damage from it may be diminished by suction. No danger results to the person himself who applies this kind of treatment. When the wound is caused by the bite of a dog or other animal, or by the sting of a snake, the free application of saliva is useful; perhaps it is the most useful application which can be put into the wound. It is comparatively useless to cauterise such a wound in the way in which it is ordinarily effected. It is often done even the day after the wound has been inflicted, but it cannot overtake the consequences produced by the offending matter. The effects of such a wound are best met by using constitutional remedies, such as the surgeon may direct. The bite of a dog is comparatively of very little consequence if the animal is not mad: probably not one in a thousand of the bites which are made by dogs in every-day life are followed by evil consequences. Most of them are produced by the animals in play. A boy finds his hand in the dog's mouth, and, withdrawing it hastily and almost instinctively, he tears his flesh by contact with the sharp teeth of the animal. No evil will be likely to follow from this accident if the boy is in good health. If the wound is seen immediately, and if there is any doubt on the point as to rabies, a solution of caustic may be applied to it; or, better still, a little nitric acid may be put on after freely sucking the wound with the lips and moistening it with saliva. If the dog is really rabid, the strong nitric acid should be applied at once to the wound, so as to destroy the whole of the bitten part; but this must be done by a surgeon, and, until the skilled practitioner arrives on the scene, suction, and then the application of some simple matter such as carbolised oil, will be all that should be attempted by an unskilled hand. Bites made by cats, horses, and other animals are occasionally very disagreeable, but to all these carbolised oil is the best application after cleansing the bitten part with warm water, and sucking the wound. If the constitution of the child is healthy, there will be nothing but local irritation set up.

The consequences of hydrophobia are, in reality, very frightful, and as a sequence to the fright produced by the bite of a dog the frequency with which mischief results is magnified. Cases are fanned into activity by the mental anxiety of the bitten person, assisted by the anxious inquiries of the friends. It is very important, as regards its effect upon the bitten person, that no inquiries should be addressed to him as to the bite or his feelings regarding it. If he can forget it, so much the better—his nervous system will not be made more sensitive or more ready to take on the nervous action, which assists to fan the disease into activity.

If a boy has been bitten by a dog which is supposed to be mad, no reference should ever be made to it by the masters; and, if possible, his schoolfellows should be cautioned against talking to him about it. If there be a minute dose only of the poison inserted in the flesh of the boy, it may be dwarfed, and it may abort instead of being fed by the morbid matter which nervous alarm itself produces, and which is the result of nerve disturbance in the boy's mind reflected upon his body. This is probably the pabulum upon which the poison feeds. It seems to be established pathologically that there is a very rapid extension of effect along the nerves from the parts injured to the spinal cord. This extension takes place during the incubative stage. The disease then affects the spinal and the sympathetic nervous system, and through them the emotional nerves in a manner which, from the effects produced, is known by the name of hydrophobia. Let me repeat that not one in a thousand of those bitten by dogs run any risk of being a victim to this terrible complaint, and probably not one in ten who have been actually bitten by a mad dog do get the disease in question. A large number of those who suffer from it have a morbid dread of it, which has been sometimes produced by the mistaken anxiety of the companions and friends of the bitten persons. If it is certain that the dog which has inflicted the wound is mad, it is right to pour some nitric acid freely into the wound, if it can be done at once, as the acid finds its way into the deepest part of the injured flesh. The application of lunar caustic is not so likely to be as

effectual, because it may not get into the deepest part of the wound itself, and then the morbid matter is not entirely destroyed. Nitric acid is sometimes better known by the name of aqua fortis. It is a powerful corrosive, and destroys every part of the skin or other tissue with which it comes into contact. It must be judiciously used. To avoid injuring another part, which ought not to be touched by the acid, we may apply a coating of sweet-oil. The oil will limit the immediate effect of the acid and prevent it from producing unnecessary injury. It would be highly imprudent to apply nitric acid in the neighbourhood of the eyes, if the wounds are upon the face, except under medical advice. It is, fortunately, very unusual for bites of rabid animals to occupy that position, the hands, arms, and calves of the legs being the parts most usually attacked, and to those nitric acid may be applied without much danger. The best way to use it is to make an extemporaneous brush by means of a wax lighter or wax lucifer match. Light the taper, let it burn a few seconds, blow out the flame, and fray out the wick into a brush form. Plunge the newly made brush into the acid and brush over the bitten flesh, letting some of the acid drop into the deepest part of the wound. The acid does not destroy the brush itself. If a medical man is at hand he will probably incise the wound so that the acid may certainly get to the bottom of it, but a knife used for such a purpose in the hands of the unskilled operator will probably be as dangerous to the victim as the bite itself. It is not therefore, to be done except *secundum artem*. The parts so treated should be covered up with carbolised oil, and preserved from further injury by keeping it perfectly quiet. More mischief is done sometimes by using the damaged part too much after an injury, than that which results from the injury itself. The application of the acid leads to the destruction of the whole of the part which is in contact with it. This destroyed part has to be removed by a kind of exfoliation, and whilst it is undergoing the process of removal, the neighbouring tissue is actively at work to repair the damage which has resulted. The destroyed part must be kept from putrificative action. Carbolised oil will effect this object, and with perfect cleanliness and quiet, will be all that will be necessary to allow the wound to heal rapidly, provided the child is in a healthy state. If he has not been excessive in the use of flesh as a food; if that flesh has been of a healthy and proper kind, and he has not been accustomed to stimulants, no evil will be likely to arise; but those children who are overfed, and who are allowed to take stimulants, run the risk of mischief from which their fellows are free. Abscesses form, or erysipelas is set up, or there is pyæmia, or so-called septicæmia results. The child is then said to be under the influence of blood-poisoning, and perhaps dies from its effects. This result arises from the *nimia cura amici* and the loved one is killed by kindness.

It is necessary to draw a distinction between hydrophobia and rabies. Many more dogs have the latter disease than the former, and there is less danger of human infection from it. Rabid dogs are inclined to bite at everything that comes in their way, whilst hydrophobic dogs only bite those who interfere with them; the former animal is thirsty, wants water, but can't drink it, and foams at the mouth, and has fits, howls and barks. The latter dreads the sight of water and is almost convulsed if made to touch it, but does not foam and does not have fits, and does not howl or bark.

As regards the treatment of dogs suspected of madness, it is wrong to kill a suspected dog at once, compulsory confinement should not, however, be long continued, as if the signs do not develop themselves soon the dogs may be let alone, but all ownerless dogs should be destroyed. I think it most unwise to muzzle the poor animals, as if anything will develop the disease, it is the miserable contrivances which are used for this purpose. It ought to be put a stop to by the Society for the Prevention of Cruelty to Animals.

Gun-shot wounds are not often likely to require attention among school boys, but the effects are to be met in the manner proposed for contused and lacerated wounds.

When small shots have penetrated some depth it is unwise to poke about with probes to try and get them out. Cover up the part with carbolised oil, and let the shot alone, it will probably become encysted and give no trouble provided the boy is in a healthy state, or it may find its way out in the course of time.

The same principles should guide in those injuries that result from the explosion of gun caps or gunpowder. It is best to avoid irritating the part by injudicious efforts to extract that which is not clearly seen: it will probably be expelled by natural processes if it be let alone.

Pieces of glass bottles and broken pottery may be easily felt, and should be extracted by the aid of forceps or tweezers. They ought not to be left in a wound, as their sharp edges are sure to irritate.

Wounds on the scalp require the hair to be cut away on either side of the wound for a short distance, and that it be picked cleanly out of the wound, otherwise it is likely to set up irritation.

Erysipelas.—This name is applied to several kinds of complaints, they are all more or less infectious, and I deal with this class here because it is so intimately associated with wounds and the bites of animals. There is the so-called St. Anthony's fire, which attacks the face, it seldom appears upon children, it is connected with errors of diet and bad feeding, rather than outward injury, but it sometimes becomes infectious and is capable of spreading from the face of one person to a wound upon the hand of another. Care must be always taken that the materials which are used for the benefit of the subject of facial erysipelas be not brought into contact with wounds upon another child, or of being in any way introduced into the bodies of children. I have every reason to believe that the fatal epidemic of peritonitis (Inflammation of the Bowels), which invaded the Royal Patriotic Schools at Wandsworth a few years ago, and which led to the death of a highly-accomplished physician, was caused by the *debris* from some cases of facial erysipelas accidentally finding their way into the drinking water with which the children were supplied. The case was not absolutely proved, but to my mind the circumstantial evidence was strong enough to be equal to proof. This kind of erysipelas is sometimes called idiopathic, as distinct from that which is styled traumatic. The terms mean that in the one case the disease has apparently appeared spontaneously, in the other it has attacked a wounded

part. In the one case it has arisen within the body, in the other it has appeared as if from without; but in both it is due to the action of infective particles which are capable of reproducing their kind in the tissues of the victim. It is probable that the germs which can set up erysipelatous action are more or less prevalent everywhere, but they do not spring into activity unless the soil (that is, the fluids of the body) are fitted to force them into active development. In some cases, in consequence of improper feeding, and from the effect of impure air, such as arises from close packing or want of ventilation, the bodies of children are extremely prone to take on this action, and several cases of erysipelas may appear in a given school in very rapid succession. If this be so, it is certain that there is one of two things, either the children are too closely packed and they have bad air supplied to them, or else that they have been fed with improper food, or both causes may be at work at the same time. Whenever such conditions arise, it is the duty of the managers to make a most searching inquiry as to the error, and if it be in their own domain, to have it rectified at once. The conditions do not often arise in day schools, because it is probably more generally due to the character of the food supplies than to outside influences; but if there is close packing in the school, the effect of bad food provided at home will be more immediately made manifest. It has been usual to consider idiopathic erysipelas as quite distinct from traumatic, but there is too close an alliance between them to doubt but that they are convertible, and that as great care must be taken to prevent the extension of the one as ought to be always done to keep the other in check. The poison which produces erysipelas may be developed in any wound, even if it be a scratch only, provided the scratch is constantly irritated by friction or by irritating applications, and the blood of the child in an impure state. It will be likely to arise in any one with impurities of a certain kind; it is especially promoted by gross feeding and the use of stimulants. It is, however, much more likely to arise in a lacerated wound, or one made by a rusty nail or other blunt weapon, than in a clean cut. A reiteration of irritation in a wound forces the particles which are the effect of the injury into a further, or rather a lower state of development. Particles which are called micrococci, or, as I prefer to call them, cacozymes, as distinguishing them from more fully-developed and healthier protoplasm, become the vehicles for the dissemination of infective material, and the chemical changes which this material induces sooner or later sets up the action which is called erysipelas. The cacozymes play, it may be, a mechanical part in the distribution of the mischief, their excretions (for they must have excretions) being the chemical agents which spread the evil. The continued reproduction of injury in a wound causes these agents to become infectious, if the soil in which they are grown is bad: and when once their infective character is established, it is propagated wherever it finds suitable soil for its development, and that soil is the ordinary state of a wounded part of the human economy. It has been shown on very satisfactory evidence that the effect of injury is the outpouring of so-called leucocytes (lymph particles) into the intercellular tissue around the part injured. If the injury is not a continuous one, the lymph is absorbed by the lymphatics, and the effect ceases; but if it be reiterated, and inflammation goes on, the lymph is the pabulum, by means of which the ordinary harmless microzymes or bacteria are enabled to increase and multiply, and change their character into infective agents or cacozymes. Let the leucocytes or lymph particles be the outpourings of an unhealthy constitution, and there is material at hand to vary the character of the fluid by means of which it becomes infective, and is capable of producing chemical changes in the tissues of other people as well as the particular subject of the injury. An infective stage is produced, and which may set up erysipelas, or in some other condition; or a so-called tubercular state of constitution may arise, according as the tendency of the child's blood leads in one direction or another.

(To be continued.)

—o—

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

Joint Author of 'The Field-Naturalist's Handbook.'

No. XVI.—THE MONKEY TRIBE.

PART IV.

WE have already seen how wonderfully the bodily frame of the monkeys inhabiting the Old World is adapted to the habits of their existence; carrying out the universal rule that the structure of every animal, be it high or low in the order of Nature, is exactly suited to the life which that animal is intended to lead.

In every detail, both of the external and internal anatomy, do we find this to be the case, from man himself, at one end of the scale, to the mere living atoms at the other which form the connecting links between the animal and the vegetable kingdoms.

Liberal, however, as Nature has been to the monkeys about which we have already been reading, as regards their physical qualifications for the existence they are intended to lead, she has been yet more generous to some of the quadrumana of the American continent, presenting them with what is to all intents and purposes a fifth limb, in addition to the four with which their less favoured relatives are obliged to be content. This additional limb, if we may so call it, is found in the tail, which differs very considerably from the caudal appendages of monkeys of other parts of the world.

Not only is this organ endowed with wonderful strength, but the extremity, which is entirely denuded of hair upon the lower surface, is gifted with so delicate a sense of touch that it can be applied to almost all the purposes for which the hand is ordinarily employed. Thus, it is equally capable of supporting the entire weight of its owner for a considerable time as he rests suspended from some lofty bough, or of abstracting the eggs from a bird's nest in some crevice too narrow for the hand to enter.

Again, when one of these Spider-Monkeys, as they are popularly termed, is moving among the branches of its leafy home the tail seems to be of paramount importance, for the animal is seldom seen to progress a single pace unless the extremity of that organ is coiled round some firm and stable bough. Upon the rare occasions, however, when no such available object

presents itself, the whole tail is thrown over the back, and serves to balance its possessor until the nature of the surroundings will again allow of its being used in the orthodox manner.

There is a curious structure about this tail which obliges it naturally to fall into the position which it assumes when coiled round a branch, or other object, in much the same manner as the hand of a human being contracts when the muscles are allowed to relax. To hold the fingers perfectly straight from the palm requires a definite exertion, and the same appears to be the case with the tail of a spider-monkey, although in a far more strongly marked degree. Neither does this peculiar provision end with the life of the animal, for, if mortally wounded, but not instantly killed, a spider-monkey almost invariably suspends itself from some branch, and expires in a pendent position; and so powerful is the action of the muscles as they stiffen in death, that the body does not fall from the bough, but continues to hang until decomposition sets in, and relaxes the rigid fibres.

It cannot but seem strange that, although they are provided with so useful an auxiliary in the shape of a prehensile tail, these spider-monkeys should yet be inferior in general activity to many of the monkeys of the Old World. Thus the gibbons far surpass them in the quickness and agility of their movements, notwithstanding the total want of caudal appendage which is one of their distinguishing characteristics.

Yet, when occasion arises, these monkeys can be wonderfully active, and will travel through the forests with rapidity equalled by no other creatures save the denizens of air, allowing nothing but a broad stream to check their course.

The smaller rivers they are said to cross in a very singular and ingenious manner.

The band having arrived at the bank, one of the most powerful animals ascends a lofty tree growing near the edge of the water, and firmly twists his tail round some overhanging bough, grasping it also with his hind feet, and allows his body to rest suspended, with his head towards the ground. A second follows him, and grasps his predecessor round the body. A third clasps the second in like manner, a fourth the third, and so on until a chain is formed of sufficient length to reach the ground.

As soon as this is the case, the lowest monkey, who is always one of the strongest of the band, pushes himself violently away from the ground in such a manner as to set the entire chain in motion, something like the pendulum of a huge clock. This movement is gradually increased until he is able to grasp some branch upon the opposite side of the stream, when he works his way up to the topmost branches, the chain of monkeys thus forming a living bridge across the obstacle to their progress. Over the bridge pass the rest of the band, until the whole number have crossed in safety.

As soon as this is the case, the first monkey releases his hold, and the bridge itself swings across the stream, the animals which compose it either dropping to the ground or clambering into the branches as soon as they reach the bank. In this manner the entire band is enabled to cross the watery barrier without the necessity of more than one or two of them wetting their fur in the passage.

Those that form the last links of the chain are necessarily dragged through the water, but they care nothing for it. Like most mammals, monkeys can swim well enough, using their arms and legs just as a dog does when it swims.

Active as they can be, however, when occasion requires, these monkeys are very far from being so as a general rule, their ordinary habits, indeed, being rather slothful than otherwise. They will sit for hours together without moving a limb, their sole object appearing to pass through life with as little active exertion as can possibly be managed.

This indolent nature is remarked by Mr. C. B. Brown, in his 'Canoe and Camp Life in British Guiana.' He tells us:—'The quatas, or large black spider-monkeys, spent a good deal of their time in trying to open the Brazil nuts by breaking them against the branches of trees, or on hard logs upon the ground; and as we passed a grove of Brazil-nut-trees it was amusing to hear the hammering sounds produced by these fellows at their self-imposed tasks. Where a single monkey was thus employed the blows were most laughably "few and far between," the creature showing its true indolent character by the slow way in which it performed its work, resting for a few minutes between every blow. It also showed an amount of perseverance, however, that one would not look for in a monkey, and a knowledge that it would eventually reap a reward for its hard labour.'

The name of 'Spider'-monkeys has been applied to the animals of this group on account of the strangely spider-like appearance caused by the small head, slight body, and long slender limbs. This resemblance is still more strongly apparent when the animal essays to walk upon level ground, its somewhat ungainly movements reminding one very forcibly of those of a large spider under similar circumstances.

To the monkeys which compose the first genus of the group the name *Ateles* has been given, on account of the almost total absence of thumbs upon the fore-paws. It is formed from the Greek words signifying the want of a joint.

In some of the spider-monkeys these organs are merely rudimentary, while in none are they of sufficient size to be of any particular service to their owner.

A curiously formed member of the genus *Ateles* is the Chameck (*A. chameck*), a native of Brazil. The remarkable appearance of this animal is chiefly owing to the length of the fur, more especially upon the hinder quarters and the tail, where it is very thick and bushy. The last few inches, however, of the latter organ are almost entirely denuded of hair upon the upper surface, and altogether so upon the lower, just as is the case with all the monkeys of this curious group.

The nostrils are very different from those of most of the quadrumana, for they open at the side instead of underneath, and are widely separated from one another by a broad cartilage.

The chameck is not a very large animal, the entire length of the body, exclusive of the tail, seldom exceeding twenty or twenty-one inches. The tail is usually about two feet in length. The animal is tolerably common in those parts of the country which it frequents, and is often taken captive and domesticated, an easier task than is the case with monkeys in general. For the temper of the chameck is unusually mild and gentle, and it does not appear liable to the sudden fits of uncalled-for passion which characterize so many of the monkey tribe when brought into captivity.

Another well-known spider-monkey is the Marimonda (*Ateles Belzebuth*), which is found in great plenty in Spanish Guiana, and also, although in lesser numbers, in other parts of Central America.

The specific name of this animal can hardly be considered as appropriate, for it is one of the most mild and peaceable in disposition of all the monkey tribe. Indeed, the colour of the fur upon the upper parts of the body, where it is of a deep jet-black hue, would seem to constitute the only possible reason why so far from descriptive a title should have been applied to the gentle and harmless marimonda.

Next we come to the famous group of the Howler monkeys, animals celebrated for the harsh and discordant cries which they continually utter from dusk to dawn, and which are audible for at least a mile in every direction. Many a weary traveller has been driven almost frantic with the dissonant yells of these alouattes, as they are often called, repose being an utter impossibility until the approaching daylight puts an end to their mournful outcry.

Even the cry of a single howler is troublesome enough, but the effect is very greatly intensified when, as generally happens, a number of these monkeys combine forces, and lift up their voices in dismal concert, each striving to outdo his companions in the strength and volume of his vociferations. Mr. C. B. Brown, whose work on British Guiana has already been quoted in this article, gives the following description of the nocturnal performances of the howler monkey :—

'At early morning, at dusk, and throughout the night, at all our camping-places, we were accustomed to hear the howlers serenading. To my mind the sounds produced by these monkeys more nearly resembled a roar than a howl, and, when sufficiently far off, are not unpleasant to the ear. When heard from a distance of half-a-mile or so, they seem to begin with low notes, swelling gradually into louder and longer ones till they merge into a prolonged roar, which dies gradually away with a mournful cadence.

'When not more than one or two hundred yards away, and consequently plainly heard, they commence with a series of short howls, which break off with grunts, and, at every repetition, become longer and longer until their voices have got fairly in tune, when they give their final roar, which dies so gradually away. Then, after an instant's silence, a few deep grunts are given, as if the remains of the compressed air in their throat drums were being got rid of.

'Listening carefully to the performance, one can detect a voice at a much higher key than the others, especially in the dying-away portion. The Indians say this is made by a dwarf monkey of the same family which accompanies every troop. I was of the opinion that it was the voice of a female howler, but the Indians, who are very careful observers, said it was not. With their black, negro-like faces, and long red beards covering the bony howling apparatus below their throats, they are curious-looking creatures.'

The late Charles Waterton took a great interest in these monkeys, especially the great red howler.

'Nothing,' he writes, 'can sound more dreadful than its nocturnal howlings.

'While lying in your hammock in these gloomy and immeasurable wilds, you hear him howling at intervals from eleven o'clock at night till daybreak. You would suppose that half the wild beasts of the forest were collecting for the work of carnage. Now it is the tremendous roar of the jaguar as he springs on his prey. Now it changes to the deep growlings as he is pressed on all sides by superior force, and now you hear his last dying moan beneath a mortal wound.'

For the capacity of uttering these varied sounds, the howler is indebted to a modification of the peculiar bones which exist in the root of the tongue. In carving an ordinary ox tongue, some small bones are always found at its base. These are portions of the 'hyoid' bone, a most remarkable adjunct to the skeleton. In the fishes it divides into a double set of arches on which the gills are supported. In some of the birds it passes on either side of the head and over the skull, the ends being fixed to the forehead.

But in the howler it is developed into an organ of sound. It is so large that when the male howler opens its mouth you can see the upper part of the apparatus in the back of the throat. Its cavity will contain, as a rule, four or five cubic inches of water.

Besides this bony sac, the larynx, or windpipe, is modified into a number of hollow pouches, and so, by means of the reverberation of air in this complicated apparatus, the howler is able to produce the wonderful series of sounds which have been described.

One of the most plentiful of the howler monkeys is the Araguato, or Ursine Howler (*Mycetes ursinus*), which, with the usual perversity of colonists in the way of zoological nomenclature, is more generally known as the baboon. It is a tolerably large animal, an adult specimen measuring nearly three feet in length, exclusive of the tail, which is at least as long as the body and head together. In colour it is a rich reddish-brown.

It was this monkey, by the way, that furnished the 'nondescript' of which Mr. Waterton was so proud. He took the head and shoulders of a red howler monkey, removed a quantity of hair from the upper part of the head, and then, by his peculiar process of taxidermy, modelled the skin so that when dry it bore a most grotesque resemblance to the head of an old man. Visitors to Walton Hall, where Mr. Waterton kept his museum until he died, mostly mistook it for a human head, and used to blame Mr. Waterton for shooting natives for the purpose of displaying his skill in taxidermy.

The flesh of the araguato is much eaten by the Indians, who capture the animal in a singular and ingenious manner. Taking a nut of the caccarali, or monkey-pot tree (*Lecythis*), which, when hollowed out, forms a capacious vessel with a small mouth, they partly fill it with sugar, and place it in some conspicuous situation in the haunts of the expected victim. The bait thus laid, they retire to some spot where, themselves unseen, they can obtain a view of the scene of action.

Before very long, a monkey detects the nut, and forthwith inserts a paw in order to obtain the enclosed dainty, of which he immediately grasps a large handful. But, although his open hand slipped easily enough through the orifice in the nut, the closed fist cannot pass through the narrow opening, and the monkey is therefore obliged to choose one of two courses, *i. e.*, to relinquish the sweet booty, or to pass the remainder of his existence with one limb imprisoned in the treacherous vessel.

To the first of these proceedings, being a very greedy animal, he is decidedly averse, and, while he is

deliberating, the hunters issue forth from their concealment, and give chase to their intended victim. Never very active upon level ground, the monkey is still further incommoded by the weight and size of its burden, and the deprivation of one of its limbs, and so quickly succumbs to the weapons of its pursuers.

Several species of howler monkeys are known to science, but as their habits are all of a very similar nature, they need not be separately described.

In the Capucin monkeys the tail is entirely covered with hair, but is nevertheless possessed of considerable prehensile power. These monkeys are all pretty and playful little creatures, and are held in great favour as pets both by the settlers and the natives.

In the next group, however, the tail entirely loses its prehensile qualities, and, although it can be coiled round any object, is quite useless as an auxiliary to the limbs in the arboreal evolutions of its owner. The monkeys of this group are known as Tee-tees, or squirrel monkeys, the latter title having been applied to them on account of their squirrel-like form, and wonderful activity among the branches. Scientifically they are known by the generic name of *Callithrix*, a word signifying 'beautiful hair,' the application of which is evident enough. They are all natives of the Brazils.

The disposition of the tee-tees is singularly mild and gentle, these pretty little animals seeming scarcely to know what anger and ill-temper means, being therein very different from the generality of the monkey tribe. In consequence of this docile nature they are greatly esteemed as household pets, and are sure to become favourites with all with whom they come into contact.

The Cuxio, or Bearded Saki (*Brachyurus Satanas*) presents a very strange appearance, on account of the long black beard which decorates the jaws and chin, and the wonderfully bushy nature of the tail. Of its facial ornament the animal is wonderfully proud, carefully carrying water to its mouth in the hollows of its hands in order that the beard may not be wetted by contact with the liquid. It is rather curious, however, that this precaution is only taken when the animal thinks itself unseen, for before spectators it drinks just like any other monkey.

As regards its disposition, the cuxio presents a very great contrast to the capucins and tee-tees, being as irascible and sullen as those animals are mild and peaceable. When attacked by one of the furious gusts of passion which seem inherent to its very nature, it becomes a very formidable antagonist, making use of its sharp teeth and powerful jaws with terrible effect. So keen are these teeth, and so strong the muscles which work them, that an infuriated cuxio has been known to drive its weapons deeply into a wooden plank; so we may easily conjecture the nature of the wounds which it can inflict upon the flesh of its luckless adversary.

Unlike the American monkeys in general, the cuxio does not live in companies, but passes a comparatively solitary existence, contented with the society of its own family. Putting the beard and the bushy tail upon one side, it is not a very striking animal in appearance, the colour of the fur being merely a grizzled brown in the male, and a dull rusty red in the female. The head is large in proportion to the remainder of the body, while its apparent size is greatly increased by the masses of thick hair which cover it, and which fall over the temple and face.

Another of these animals, the Black Yarke, or White-headed Saki (*Pithecia leucocephala*), may at once be recognized by the thick fringe of white hair which surrounds the face. Reversing the usual order of things, this hairy fringe is comparatively short in the male, but long and drooping in the female. The fur of the body and limbs is of a deep blackish-brown hue, except upon the throat and chin, which are almost denuded of hair, the naked skin being of an orange colour.

This animal, in common with the cuxio before described, is said to feed almost entirely upon wild bees and the honeycomb which it extracts from their nests.

(*To be continued.*)

Eminent Practical Teachers.

PESTALOZZI.

BY THE REV. CANON WARBURTON, M.A.,

Her Majesty's Inspector of Training Colleges for Schoolmistresses.

IV.

A REVIEW of the characteristic features of Pestalozzi's educational system was promised in this number, but since the date at which the last notice of him appeared, its contributor has been put in possession of some original MSS. written from Yverdun Castle in the years 1819—22, of which he is permitted, by the kindness of the writer's daughter, to bring a few extracts before the readers of this periodical. It seemed desirable that, being chiefly of a personal character, these extracts should follow the account of Pestalozzi's life, and precede that of his system. The letters are numerous and interesting, but the special information bearing upon Pestalozzi is so frequently mixed up with matters of a private nature, that it cannot always be communicated to the general reader. The writer of these documents, the late Dr. Mayo, so well known in later life in connection with his school at Cheam, and with the Home and Colonial Training College—was, when a young man, engaged for some years as chaplain and English instructor in Pestalozzi's great institution at Yverdun, and the letters will, it is hoped, be read with interest as giving the fresh and unstudied expression of the writer's experiences of the place and of the man.

'1819.

'Yverdun.—On the margin of a lake, the length of which the eye is not certain that it defines, a collection of houses presents itself; a church steeple rises above the roofs, and near it four towers of no great elevation at the four angles of a large building, arrest your attention.... Observe it a little more attentively:—one tower, you perceive, is much higher than the other three; all circular and covered with something like an inverted "pottle" of tiling. They are connected by a plain frontage with a heavy sloping roof, pierced with irregular windows, and deformed with various appendages.... Without grandeur, picturesque beauty, elegance or neatness, without excellence in form or colour, it presents the most uninteresting *mélange* of incongruous parts I ever beheld. This delectable *morceau* of Swiss architecture you approach through a miserable avenue of starveling poplars, which you

behold with more than ordinary disgust, from the disappointed hope which you had formed, that when you quitted France you had seen the last of them.... I was conducted to the château, and introduced to the principal members of the establishment. Several of them had assembled in the best room of the building, and among them Pestalozzi, whom, to do honour to the English clergyman, the institution had had washed, shaved, and dressed. This circumstance made the double salute with which he honoured me less overpowering than some I have since received. But you wish me to describe him:—he is then, to use a phrase more expressive than elegant, a little weazen old man, upwards of 70, stooping a good deal in the shoulders, but apparently from a habit of looking on the ground, and not from age or decay. There is nothing very remarkable in his countenance, no very peculiar expression of benevolence, no strong indication of a powerful mind, that I could discern. There is an air of abstraction, but that I think a very ambiguous sign, and it shows that the mind is prone to wander from the sphere in which the body actually moves, but it does not indicate whither it has wandered, or whether it is vigorously and efficiently occupied. His walk, when he is by himself, is a shuffle, effected by a curvilinear movement of his legs which, without lifting his feet from the ground, makes them form a kind of oval, completed by his bringing his toes into contact. When he is receiving guests, or leaving a room with strangers in it, he adds to the shuffle a kind of jerk, which however does not reach lower than his ankles. Schmid, the active manager of the institution, has much more of the air of a man of the world....The general cast of his face and figure indicates strength: he strikes you as a man of powerful mind, devoting its energies to practical purposes.'

'1819.

'It is delightful to live under the same roof with Pestalozzi: every action of his life is characterized by the most exuberant philanthropy. Had (this) been checked by a little more prudence, it would perhaps have produced more benefit to mankind.'

'1819.

'Things go on here pretty well. For myself I am quite satisfied, but Schmid wants in heart what P. wants in head. He (Pestalozzi) is a strong instance of the necessity of a little worldly prudence: the want of it has involved him in difficulties and hardships through life: has cooled his friends, heated his enemies, cramped his exertions for the good of others.'

'1821.

'While we were sitting at dinner on Saturday, the Crown Prince of Denmark was abruptly ushered into the room. We all jumped up from our chairs. Old P. was as brisk as a bee—did the honours with his usual grace; while the rest of the party, one by one, made their escape. I had the honour of being introduced. He is a fine-looking man, affable and easy in his manner. The Princess was affected even to tears at the examination of the little children, and both declared that had they been educated in the same manner their knowledge would have been more extensive and more clear. These are our gleams of sunshine. . . . One honest John Bull, who was accidentally born a peer of the realm (good honest man, he could not help it)—has been to see us, and cried out to her ladyship, "Come, don't dawdle here—it's nothing more than the English plan, only more troublesome."

'Mrs. —— is continually boring P. with the praises of ——, (a gentleman to whom he once addressed a series of letters on the philosophy of education, but) from whom P. is now entirely estranged as a philosopher. He answers not a word. It is amusing to see them together. The other day she told P. that —— had picked up *his* most beautiful ideas. He said not a word. She then observed that —— had seized the spirit of the system better than any other Englishman. P. was silent. She then turned round to me and made the same remark in French. I parried the question in a manner that made P. laugh heartily. Schmid told me afterwards that P. was hugely tickled with what I said, and recounted the whole circumstance, laughing most immoderately. The next time P. saw me he placed both his hands on my shoulders and fell to laughing and kissing, kissing and laughing, so that a bystander must have taken him for a fool.'

'1821.

(Dr. Mayo having had an acute attack of illness) 'Pestalozzi was terribly uneasy; he could not rest till the symptoms declared themselves more favourable. He said, "*J'ai eu crainte, comme un pauvre diable.*" He comes early in the morning to my bedside, kisses my hand when I place it in his, and when I tell him I am better he is quite delighted, and exclaims, "*Grâces à Dieu—grâces à Dieu!*"'

'1821.

'Pestalozzi completed this day his 76th year. His grey hair, his careworn countenance, his hollow eye and bent figure, proclaim that many days, and those days of trouble, have passed over his head. His heart, however, seems still young—the same warm and active benevolence, the same unconquerable hope, the same undoubting confidence, the same generous self-abandonment animate it now, that have led to the many sacrifices and have supported him under the many difficulties and trials of his eventful life. In a thousand little traits of character, which unconsciously escape him, I read the confirmation of his history. It is an affecting sight when the venerable object of the admiration of emperors and princes appears in the midst of his adopted children. Rich and poor, natives and foreigners alike, share his paternal caress and regard him with the same fearless attachment.

'From the sacrifice of home, property, and health for the benefit of a people who do not understand his merit, to the picking up of a child's plaything or the soothing of an infant's sorrow, Pestalozzi is ever prompt to obey the call of humanity and kindness. The sentiment of love reigns so powerfully in his heart, that acts of the highest benevolence or of the most condescending good nature seem to require no effort, but appear the spontaneous manifestations of the one overruling principle.

'I must tell you an anecdote which, simple as it is, shows at once the warmth and the weakness which characterize his benevolence. He was going to visit some friends at Berne, furnished with as much money as he was likely, under such circumstances, to want. According to his usual practice, he falls into conversation with the first peasant to whom he has an opportunity of speaking. He inquires into his means of subsistence, the number of his children, the want and distresses of his family, and so forth. Becoming in-

terested in the man's little story, Pestalozzi gives him the larger portion of the money which he has about him. A similar case soon afterwards presents itself, and the second *recontre* drains his pocket of the last *kreutzer*.* He had nearly reached Berne, when a wretched-looking mendicant comes up to him soliciting relief. Again he fumbles in his pocket, but it is now in vain. What is to be done? He remembers that his buckles are of silver; he hastily takes them from his shoes, thrusts them into the beggar's hand, and drives off.

'Though regarded in Germany as the most extraordinary luminary, and the profoundest practical philosopher of the age; though honoured with the most flattering testimonies of esteem and approbation by courts and universities, Pestalozzi is the most modest and unassuming of men. To all who take an interest in his method of education he addresses himself in the most touching expressions of gratitude, as if they conferred the greatest obligation by examining into the truth of his opinions and the utility of his plans.

'Never shall I forget my first introduction to him. He had been long expecting me, and his lively imagination had anticipated in different manners the probable results of our connection. "Will he like me? Do you think I shall suit him?" were questions he was perpetually putting to our common friend. I had no sooner arrived than he hurried to meet me, and though I understood not the words he uttered,† yet the tone of kindness, the affectionate pressure of the hand, the expression of benignity which lit up his countenance, all assured me I was welcome. Twenty times he rose from his seat, paced with quick, but shuffling step across the room; then, as if suddenly recollecting himself, hastened to place himself near me, to press once more both my hands in his, and to mutter some unintelligible expressions of goodwill.

'In one of the first conversations we had together, he told me how delighted he was that the English began to pay attention to his system, remarking that that union of exalted sentiments with practical good sense which characterizes the nation renders it the most competent to appreciate and execute his plans. "Examine my method," continued he, with his noble candour, "adopt what you find to be good, and reject what you cannot approve. We are doing something here towards the execution of my principles of education, but what we do is still very imperfect: it is in England that my views will be eventually realized."

'You cannot conceive the interest which Pestalozzi awakens, or the influence which he insensibly acquires. All the little barriers behind which reserve or suspicion teach us to entrench ourselves, fall before the childlike simplicity, the unaffected humility, and the feminine tenderness of his heart. Self-interest is shamed into silence while we listen to the aspirations of his boundless benevolence, and if one spark of generous feeling glows in the bosom, the elevated enthusiasm of his character must blow it into a flame. The powers of his original mind serve to maintain the interest which his character first excites. In conversation, however, he is most frequently a listener. Towards those with whom he lives in perfect intimacy he sometimes indulges in a playful but forcible raillery—careful, meanwhile, to avoid giving the slightest pain or uneasiness. He is peculiarly successful in portraying some great character by two or three masterly strokes: in marking, either in retrospect or by anticipation, the influence of political events on national character or national prosperity; in characterizing the different methods of education in vogue; or in tracing the difference between his (own) views and those of certain philosophers, with which they have been confounded.

'There is nothing studied about him. Often as I have heard him enter upon the subject of his system for the information of strangers, I do not recollect him to have taken it up twice from the same point of view. When we have conversed on these subjects, I have sometimes thought his ideas wild and his views impracticable. The faint and misty, but still beautiful light which emanates from his mind I have regarded with a feeling of melancholy delight, for it seemed to indicate that the sun of his genius had set. Still I have been unable to dismiss from my mind his loose and ill-digested hints: after frequent reconsiderations of them, they have appeared more clear and more feasible, and I have subsequently traced their influence in the opinions I have adopted, and in the plans of instruction which I have pursued.

'Pestalozzi once known is never forgotten. I have talked with men who have not seen him for years, or whom the current of events has separated from all intercourse with him. His honoured image lives as fresh in their memory as if their communication had never been suspended or broken. Anecdotes illustrating his benevolence are current in their families, and their children anticipate the delight of one day receiving the parental caress of good Father Pestalozzi. Many of my own countrymen, who have enjoyed the privilege of his society, will, I am sure, carry the remembrance of him to their graves. For myself—his unwearied kindness, his affectionate solicitude for my health and comfort, the numberless testimonies of his esteem and regard which I daily receive, are engraven on my heart in characters which can never be effaced.

'It will ever be a source of proud satisfaction to me that Pestalozzi has honoured me with the title of friend; and should I attain, myself, to a good old age, my decline will be cheered with the remembrance that I have contributed, as he himself declares, to shed a happy serenity over the evening of his life.'

Mr. Mayo appears to have, in the first instance, attached himself to Pestalozzi's staff without any ulterior object; but the idea gradually dawned upon him of first imbuing himself thoroughly with the principles of the great master, and then returning home and establishing a Pestalozzian School in England free from the oddities, the irregularities, the waste, the dissensions, and, alas! the *dirt* which clogged the works of the Swiss institution. In a letter dated Jan., 1820, he talks of 'setting up a Pestalozzian menagerie of his own.' 'The die,' he writes, Oct., 1820, 'is cast for me: I am a Pestalozzian through life, with no other temporal object but the establishment of this method of education in my own country.' In this idea he was strongly encouraged by Pestalozzi himself, whose great ambition and desire was that his principles should be planted in England, where he thought the conditions peculiarly favourable to their taking root.

When Mr. Mayo left him, Pestalozzi presented to him, among other parting gifts, a screen, now in the

* Kreutzer, a German coin worth a little more than a farthing.

† The writer did not, at this time, understand German.

possession of Miss Mayo, with a likeness of himself in his own study at Yverdun, and with pictures on the study walls of Stanz, of 'Gertrude teaching her Children,' and of a green and flourishing tree, representing his own never-dying hope. He also conferred upon Mr. Mayo a sort of testimonial, written in German of the most involved and clumsy character possible, which concludes thus:—

'He has, with great readiness, deep insight, and gratifying success, aided me in my pursuit of the main object of my life; in regard to which, by his unprejudiced, calm, and at the same time cordial behaviour, he has attained to a very intimate and thorough familiarity with our purposes, principles, and methods, and especially with the peculiarities of our system of education and instruction. So much has this been the case, that I have long since learned to regard him as a matured and benevolent counsellor in my own domestic concerns.

'I am convinced that, as his presence has proved a blessing to myself and to my house, it will also (through his mature insight into our efforts and his firm conviction of the great and essential advantages which some, at least, of them offer) prove, in time to come, a blessing also to his native land, so wont to embrace with vigour, and promote with liberality, every good movement which comes under its notice. His noble heart cherishes this desire as warmly as his intellect grasps the means of attaining it in all its purity, depth, and manysidedness.

'God be with you, my dear, dear friend! May my heartfelt thanks, my sincerest affection, and the ardent longing once again to meet you in this world, and once again by your side to indulge hopes which can only be fulfilled beyond the grave, accompany you on your way and bring you happily home to your fatherland, and to the mother whom you love so heartily and so filially, 'PESTALOZZI.

'*Yverdun, Switzerland, April 8th*, 1822.'

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

THE third stage of this subject is the one in which the boys manifest the greatest interest. All the facts can be laid open to their view by striking experiments. Indeed, the boys themselves may work the experiments, and from their own observation of the facts arrived at, deduce the law. I have before stated, that speaking generally, the whole syllabus of this subject—Mechanics—may be arranged thus:—

1st stage; Matter; its states, and properties.
2nd „ Matter acted upon by force.
3rd „ Force accomplishing work.

The third stage embraces what is usually understood as mechanics; while stages 1 and 2 pass under the more general term, 'Natural Philosophy.' The following is the syllabus of the third stage as it appears in the Code.

Simple mechanical powers: liquids under pressure: the hydrostatic press: liquids under gravity, or the gravity of liquids: parallelogram of velocities and of forces.

As in stages 1 and 2, I have prepared a detailed scheme of lessons to be given during the year; and from which the Inspector has always selected the questions for examination. It is as follows:—

1. Simple mechanical powers: meaning of machine: simple machines: complex or compound machines: (*a*) the lever; different kinds; definition; relation between power and weight, power arm and weight arm: meaning of statement that 'power is gained at the expense of time or distance.' Centre of gravity of lever. Every-day instances of use of lever. (*b*) The wheel and axle: definition: a modification of the lever: common instances of its use: relation between power and weight, diameter of wheel and of axle; units of work performed by power equals those performed by weight. (*c*) Pulleys: definition; fixed and movable pulleys: block pulleys; common instances; relation of power and weight. (*d*) Inclined plane: definition; common uses; advantage gained; relation of power, weight, length of plane and perpendicular height. (*e*) Wedge and screw.

2. Liquids under pressure. Difference of results by exerting pressure upon the surface of a liquid and on a solid. Law of liquid pressure: liquid pressure due (*a*) to the exertion of mechanical force, or (*b*) to the gravity of the liquid. The hydrostatic press, its construction and principle of action: an instance of the 'dispersion of force but not of its creation:' meaning of this.

3. Liquids under gravity: meaning of 'gravity of the liquid,' *i.e.*, its tendency to fall to the earth. Difference between solids under gravity and liquids under gravity, a difference due to the greater mobility of the molecules of the latter. The pressure of liquids due to their gravity: pressure of liquids on the sides and bottoms of the containing vessels: construction of reservoirs. The surface of liquids at rest is level, why? The amount of convexity of liquids on the earth's surface is eight inches in a mile, reason of this. Floating and immersed bodies; why a body sinks, why it floats. Law of liquid displacement. Centre of buoyancy. Weight of water; specific gravity.

4. Parallelogram of velocities and of forces: resultants as to velocity and force when two or more forces act in same direction, or in opposite, or in different but not opposite directions.

From this syllabus, it will be seen and readily acknowledged that there certainly is no other subject of ordinary elementary instruction that can possibly exert so great an educative influence over the minds of the boys, or which is likely to be of more practical utility in their after lives. At the risk of being considered boastful, I will mention an incident that occurred the 27th of last month. I am on the Committee for the extension of university teaching. We determined to wind up a very successful course of lectures by Dr. Lavington Hart, on electricty, by giving a scientific soirée. During the evening we had an exhibition of the various forms of electric lights, arc, and incandescent; of telephones, microphones, phonographs, etc. At one end of the hall, a crowd had gathered round a gentleman who was energetically explaining the construction and action of a phonograph he had himself made. I thought I knew this gentleman. Later on in the evening he came to me, shook hands and asked if I remembered him? I was sorry to say I had forgotten his name, but knew his voice and features. Then he said 'I

was a boy in your old British School. You gave a course of lessons on mechanics and machinery; and one day explained the action of the steam engine from a working model that your brother had made. Well, you led us to see the necessity of having some contrivance for admitting the steam to the upper and lower part of the cylinder alternately. You did not explain how this was done, you left us in a fog about it; but you told us to go home and write out in our exercise books any plan we could think of that would accomplish what was wanted. It was the first and greatest delight I ever had in my life, when, after examining our books, you came, and before the whole division, stated that I was the only boy who had thought of a plan that would do, and that I had in fact hit upon the exact principle of action of the D valve: which you then showed us in the model. Well sir, that little event shaped my future. I have been for the last two or three years an electric engineer.' (*Note.*—I have given the Editor the name and address of this gentleman, though of course not for publication.) Now I should like to ask my fellow-teachers whether anything like this educative influence can be obtained by teaching any other of the Fourth Schedule subjects? Well may the School Board Inspectors express regret, as they all do in their annual reports, that 'Mechanics' is so seldom taken. Physiology is almost universal. In fact Her Majesty's Inspectors have told me that they are quite sick and tired of hearing and reading about 'humerus,' 'ulna and radius,' etc. Against teaching the *science* of physiology I say nothing, but, as Dr. Gladstone remarked to me last Monday, we never get to the science. What real educative value can there possibly be in learning by rote the mere names of some bones, some muscles, and certain parts of the body! 'Please mum,' wrote a fond and anxious mother to a head mistress in my neighbourhood, 'don't teach my little gall no more about her inside, it don't do her no good, and its rude.'

If a teacher decides to take mechanics, he will have to make his own apparatus. He will want something to illustrate the mechanical powers, to begin with. I heard that the School Board for London let out on loan to its teachers a box of models. I at once applied; and after waiting six months, received a little box of the stupidest jimcracks it is possible to conceive of. It was an exercise of Jobic patience to set them up. When they were set up they would not work, or, if they did, showed a result quite different from the one, one wanted. I put them away 'to be called for,' and set about making my own. In next month's PRACTICAL TEACHER will appear a wood-cut of what I have constructed, with hints how to make it; for it will be found very useful in 'object lesson' teaching, as well as mechanics. It is strong enough for the boys to work themselves. In fact I have not given the class a single rule for working sums in connection with the mechanical powers, etc.; the boys have educed the rules themselves from the experiments they themselves have performed. And how delighted the boys are when the time for this lesson comes round! One boy stands on the table to be high enough to fix the various things on the frame; another boy stands by the table to tell him what to do; and a third boy stands by the black-board with a piece of chalk ready to write down the result of each experiment which is to lead up to the general conclusion. And as for codes, examinations, and percentages, not a thought like that enters my philosophic pate, or troubles it at all.

—o—

ANSWERS TO

Pupil Teachers' Examination Paper.

APRIL 29TH, 1882.

CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. If a stick 2 feet 6 inches long standing upright casts a shadow 3 feet 2 inches long, how high is a tower which at the same time of the same day casts a shadow 57 feet long? Work this sum by the rule of three, and prove your result by the "method of unity," or "first principles."

3 ft. 2 in. : 57 ft. :: 2 ft. 6 in. : height required.
or 38 in. : 684 in. :: 30 in. :

$\frac{30 \text{ in} \times 684}{38} = 540 \text{ in.} = 45 \text{ ft.}$ Ans.

Proof:—
A shadow of 38 in. is cast by a height of 30 in.
∴ " 1 in. " " $\frac{30}{38}$ in.
and ∴ " 684 in. " " $\frac{30}{38}$ in. × 684
i.e., 540 in. or 45 ft.

2. Compare the cost of 150 oranges at 9½d. a dozen, and that of 3¾ lbs. of tea at 2s. 7d. a lb.

(*a*) 150 oranges at 9½d. per doz. = 12½ at 9½ each = 9s. 6d. + 4¾d. = 9s. 10¾d.
(*b*) 2s. 7d. × 3¾ = 31d. × ¹⁵/₄ = ⁴⁶⁵/₄d. = 116¼d. = 9s. 8¼d.
∴ (*a*) is greater than (*b*) by 2½d.

3. Find the total value of—
3019 articles at 18s. each.
517 articles at £1 18s. each.
2466 articles at 16s. per dozen.
620 dozen at £2 4s. per score.

			£ s.
3019 arts. at 18s. each	= £3019	− £301 18s.	= 2717 2
517 " at £1 18s. "	= £1034	− £51 14s.	= 982 6
2466 " at 16s. per doz.	= £205 10s.	− £41 2s.	= 164 8
620 doz. at £2 4s. per score	= £744	+ £74 8s.	= 818 8
		Total value	= 4082 4

4. 518 ac. 3 rd. 7¾ poles at £18 7s. 6d. per acre.

		£ s. d.
Value of 1 ac.		18 7 6
		518
" " 518 ac.		9518 5 0
" " 2 ro.	= ¼ val. of 1 ac. =	9 3 9
" " 1 "	= ½ " 2 ro. =	4 11 10½
" " 5 po.	= ¼ " 1 " =	0 11 5¹³/₁₆
" " 2½ "	= ½ " 5 po =	0 5 8¹³/₁₆
" " ½ "	= ⅕ " 2½ " =	0 0 6¹¹/₁₆
	Total value =	9532 18 5¹¹/₁₆ Ans.

FEMALES.

1. Find the cost of 62,689⁸/₁₉ at £9 13s. 10½d. each.

		£ s. d.
Value of 62,689 at £1 each	=	62,680 0 0
" " 9 "	=	9
		564,201 10 0
at 10s.	= ½ val. at £1 =	31,344 10 0
3s. 4d.	= ⅓ " 10s. =	10,448 3 4
5d.	= ⅛ " 3s. 4d. =	1,306 0 5
1d.	= ⅕ " 5d. =	261 4 1
½d.	= ½ " 1d. =	130 12 0½
Value of ⁸/₁₉ at £9 13s. 10½d. ea.	=	1 10 7¹¹/₁₉
∴ Total value	=	607,693 0 5¹¹/₁₉

2 Make out the following bill:—18 lbs. of roasting beef at 7½d. per lb., 29 lbs. mutton at 8½d. per lb, 16 lbs. veal at 10d. per lb., 47 lbs. of pork at 9½d. per lb., 85 lbs. boiling beef at 6½d. per lb., 48 lbs. lamb at 7 per lb.

			£	s.	d.
18 lbs. at	7½d.	per lb. =	0	11	7½
29 lbs. at	8½d.	per lb. =	1	0	6½
16 lbs. at	10d.	per lb. =	0	13	4
47 lbs. at	9½d.	per lb. =	1	16	2½
85 lbs. at	6½d.	per lb. =	2	6	0½
48 lbs. at	7d.	per lb. =	1	8	0
			7	15	9½ Ans.

3. If a housekeeper has 3 fires burning regularly, each consuming 30 lbs. of coal daily; what will his year's coal bill be when coals are 13s. 6d. per ton?

lbs. of coal consumed annually = 30 lbs. × 3 × 365 = 32,850 lbs.
∴ 2,240 lbs. : 32,850 lbs. :: 13s. 6d. : amount of bill.

$$\frac{162d. \times 32850}{2240} = \frac{2660850d.}{112} = 2375\tfrac{45}{112}d. = £9\ 17s.\ 11\tfrac{45}{112}d.$$

4. What is the value of 70 tons 7 cwts. 2 qrs. 22 lbs., at £37 18s. 8d. per cwt?

			£	s.	d.
Value of	1 cwt.	=	37	18	8
				1407	
,,	1407 cwt.	=	53372	4	0
,,	2 qrs. = ½ value of	1 cwt. =	18	19	4
,,	14 lbs. = ¼ ,,	2 qr. =	4	14	10
,,	7 lbs. = ½ ,,	14 lbs. =	2	7	5
,,	1 lb. = ⅐ ,,	7 lbs. =	0	6	9⅐
,,	whole	=	53,398	12	4⅐

Grammar.

1. Point out and parse all the verbs and adjectives in the following:—

'Yet when her master's children
Would clustering round her stand,
She sang them ancient ballads
Of her own native land;
And when at morn and evening
She knelt before God's throne,
The accents of her childhood
Rose to her lips alone.'—PROCTOR.

her—pronom. poss. adj., limiting *master*.
would—auxiliary defec. verb *will, would*, past indic., forming with infin.
stand—past indef. potential of *stand, stood, stood* (intrans. and irreg.), 3rd pers. plur., agreeing with *children*.
clustering—neg. trans. verb, incomplete part., qual. children.
sang—irreg. trans, verb, *sing, sang, sung*, indic., past indef., 3rd pers. sing., agr. with *she*.
ancient—adj., qual. *ballads*.
her own—pron., poss., adj., qual. *land*.
native—adj., qual. *land*.
knelt—irreg. intrans. verb, *kneel, knelt, knelt*, indic., past indef., 3rd pers. sing., agr. with *she*.
her—pronom. poss. adj., limiting *childhood*.
rose—irreg. intrans. verb, *rise, rose, risen*, indic., past indef., 3rd pers. plur., agr. with *accents*.
her—pronom. poss. adj., limiting *lips*.
alone—adj., predicative of *accents*.

2. Point out all the nouns in the possessive and objective cases in the above, and account for their case in each instance.

master's—possessive, to show the possession *children*.
God's— ,, ,, *throne*.
ballads—objective, governed by trans. verb *sang*.
land— ,, ,, prep. *of*.
morn— ,, ,, ,, *at*.
evening— ,, ,, ,, (*at*).
throne— ,, ,, ,, *before*.
childhood— ,, ,, ,, *of*.
lips— ,, ,, ,, *to*.

Geography.

Answer *two questions*.

1. Trace the course of a vessel, sailing round the coast of Ireland, mentioning in order, and describing as fully as you can, the headlands, inlets, and sea-ports it would pass.

or, draw a map of the whole or part of this coast.

Fair Head is a large mass of bare rock with cliffs 200 feet high. Turning to the south-east we come to *Belfast Lough*, at the head of which is *Belfast*, the second city in Ireland and chief seat of the linen manufacture; having a most important cross-channel trade. Leaving the Lough we go south to *Strangford Lough*, entering it by a channel six miles long, which leads into a basin fifteen miles long and five or six broad. Passing *Dundrum* and *Carlingford Bays* we come to the *Bay of Dundalk*. The ports of *Dundalk* and *Drogheda* export considerable quantities of agricultural produce. Rounding *Howth Head* we enter *Dublin Bay*, on which stands *Kingston* the port of Dublin. Continuing south we pass *Wicklow Head, Cahore Point, Wexford Harbour*, on which stands *Wexford*, with shipbuilding and extensive trade, and round *Carnsore Point*, the S.E. extremity of Ireland. The voyage along the south coast takes us past *Hook Head, Waterford*, an outlet for agricultural produce, on *Waterford Harbour*, beyond which is *Tramore Bay*, one of the most dangerous places on the Irish coast. We next reach *Youghal Harbour*, and continue our course to *Cork*, whose harbour is capable of containing the entire navy of England, and in the middle is Goat Island, with *Cove* or *Queenstown*. *Cork* is the third port of Ireland, corn and live stock being the chief exports. It trades also with Portugal, Mediterranean, Baltic, and Canada. Passing *Kinsale*, with its excellent harbour and Cape Clear Island, we come to *Mizzen Head*. On the west coast we pass *Bantry*, one of the finest harbours in Europe, *Kenmare River, Valentia Harbour*, an excellent fishing station and harbour. *Dingle Bay*, which is very shallow, *Tralee Bay*, and enter the *Mouth of the Shannon*. Sixty miles up the river stands the port of *Limerick* with trade in agricultural produce. Rounding *Loop Head* we sail north-east and enter *Galway Bay*, on which stands *Galway*, with important salmon fishery. Passing *Slyne Head* we come to *Clew Bay*, at the head of which stand the thriving ports of *Westport* and *Newport*. Sailing past *Erris Head* we turn east to *Killala* and *Sligo Bays* (*Sligo* is a thriving commercial town), north, past *Donegal Bay, Rossan Point, Bloody Foreland*, to *Lough Swilly*, twenty-five miles inland, with good anchorage, though seldom visited by ships. Rounding *Malin Head* we enter *Lough Foyle*, on which stands *Londonderry*, with considerable trade with America and the West Indies. Beyond *Bengore Head* we arrive at *Fair Head*, whence we set out.

2. Describe fully as for children, the mountains and rivers of Wales.

N.B.—Do not give a mere string of names, but *describe* position and character.

The greater part of Wales is occupied with the Cambrian range which is properly an offshoot of the Pennine range, and the connection may be easily traced on the map. The range consists of two parallel chains, one along the north, and the other along the south coast, with a connecting chain between their middle parts running N. and S., forming a figure somewhat like a capital Π lying on its side. The *northern range* contains Snowdon, the highest mountain in South Britain, 3590 ft. high. The *central chain* contains Cader Idris, 2950 ft., and Plynlimmon, 2463; and the *southern chain* has Brecknock Beacon, 2862 ft., and the Malvern Hills which approach the Cotswold Hills on the opposite side of the Severn, a river which rises in Plynlimmon, and derives its head waters and the right-bank tributaries from the Cambrian range. In general this range forms the water-parting between the Severn and Bristol Channel on the one side and the Irish Sea on the other. The Dee, the Clwyd, and Conway flow to the N., the Dovey, Ystwith and Teify to the W., all into the Irish sea; the Towey, Tawe, and Taff, into the Bristol Channel; the Rumney, Usk, and Wye, into the Severn. The rivers that flow north and west, with the exception of the Dee, are mere mountain streams, and quite useless for navigation or harbourage. The Severn, Wye, and Usk, are all rivers of importance, but it is only along their upper valleys where the streams are but mountain torrents that these rivers are included in Wales. The Taff, Neath, and Tawe, are only important for their harbours, but the Towey has a longer course, and plays an important part in marking the geographical boundary between the geological regions of Wales.

3. Name *three* towns in each of these counties; *Cheshire, Durham, Aberdeenshire*, and say what you know about each.

(*a*) *Chester* exports cheese,—burial place of Matthew Henry, the commentator,—a very old town.
Birkenhead, a new town opposite Liverpool—fast rising into importance.
Stockport has coal in the neighbourhood, with large manufactures of cotton, silk, machinery, brass and iron goods.

(*b*) *Durham* has a university; a cathedral; a castle built by William the Conqueror; valuable collieries in the vicinity.

Sunderland, great coal-port, has ship-building, and an immense cast-iron bridge over the Wear.

Hartlepool has steam navigation to Hamburg, Rotterdam, and Antwerp.

(*c*) *Aberdeen* is a handsome city of grey granite, a place of great trade, and the seat of a university.

Peterhead, a thriving town near Buchanness, has an important herring fishery, and is a great emporium of the whale-fishery.

Fraserburgh has considerable trade in connection with the herring fishery.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

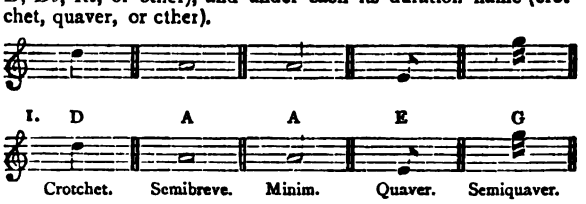
Write, in large hand, as a specimen of copy-setting the word *Zuider Zee*.

Write, in small hand, as a specimen of copy-setting, *Have you prayed to-night, Desdemona?*

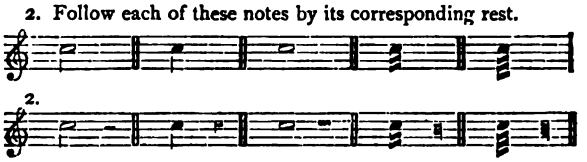
Music.

A quarter of an hour allowed for this paper.

1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a dotted minim?

3. If we make *one* beat while we sing a crotchet, we shall make *three* beats while we sing a dotted minim, because a dotted minin is equal in duration to three crotchets.

FIRST YEAR.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. Find the value of ($\frac{1}{2}$ of £ + $\frac{3}{4}$ of a guinea − $\frac{5}{6}$ of 15s.) × $\frac{6}{13}$.

$$(6s.\ 8d. + 6s. - 6s.\ 8d.) \times \tfrac{6}{13} = \frac{63 \times 31}{32} = \underline{5s.\ 9\tfrac{3}{8}d.}$$

2. Reduce 12 hours 55 minutes $23\frac{1}{17}$ seconds to the decimal of a day.

$$\frac{12 \text{ ho. } 55 \text{ min. } 23\frac{1}{17} \text{ sec.}}{24 \text{ ho.}} = \frac{60480}{86400 \times 13} \text{ sec.} = \tfrac{1}{17} = \underline{\cdot 5\dot{8}4615\dot{3}8\dot{4}6}$$

3. What vulgar fraction of a mile represents the same length as three-quarters of an inch?

$$\frac{\frac{3}{4} \text{ in.}}{1 \text{ ml.}} = \frac{\frac{3}{4} \text{ in.}}{63360 \text{ in.}} = \tfrac{3}{253440} = \underline{\tfrac{1}{84480} \text{ of a mile.}}$$

4. If ·2856 lbs. cost £·2884, what is the price of 49·47 lbs.?

·2856 lbs. : 49·47 lbs. :: £·2884 : price required.

$$£\frac{·2884 \times 49·47}{·2856} = £\frac{14·267148}{·2856} = £49·955 = \underline{£49\ 19s.\ 1\tfrac{1}{2}d.}$$

FEMALES.

1. A bankrupt pays his creditors 2s. 7½d. in the pound, and his total payments amount to £750 10s. 6d.; what are his debts?

2s. 7½d. : £750 10s. 6d. :: £1 :: debts.
or or
63 half-d. 360252 half-d.

$$£\frac{1 \times 360252}{63} = £5712\tfrac{252}{63} = \underline{£5718\ 5s.\ 8\tfrac{1}{2}d.} \text{ Ans.}$$

2. If the wages of 27 mechanics for 15 days amount to £135, how many workmen, earning the same rate of wages, may be employed 25 days for £200?

25 days : 15 days
£135 : £200 } :: 27 men : No. required.

$$\frac{27 \text{ men} \times 15 \times 200}{25 \times 135} = \underline{24 \text{ men.}} \text{ Ans.}$$

3. If 500,000 bricks, 9 inches long, 4½ in. wide, and 4 in. thick, be required to build a lecture hall, how many would be required 10 in. long, 5 in. wide, and 4½ in. thick?

9 × 4½ × 4 = 162 c. in., content of bricks first used.
10 × 5 × 4½ = 225 ,, ,, ,, to be used.
∴ 225 : 162 :: 500,000 bricks : No. required.

$$\frac{500{,}000 \times 162}{225} = \underline{360{,}000 \text{ bricks.}} \text{ Ans.}$$

4. If a clerk has a salary of £75 10s. a year, commencing 1st February last, how much should he receive on leaving his employment on the evening of the 6th of next September?

28 + 31 + 30 + 31 + 30 + 31 + 31 + 6 = 218 days in all.
∴ 365 : 218 :: £75½ : sum required.

$$£\frac{151 \times 218}{2 \times 365} = £45\tfrac{181}{730} = \underline{£45\ 1s.\ 10\tfrac{1}{2}d.} \text{ Ans.}$$

Grammar.

1. Point out and parse the adjectives and prepositions in the following:—

'On either side the river lie
Long fields of barley and of rye,
That clothe the wold and meet the sky;
And thro' the fields the road runs by
To many-towered Camelot.'—TENNYSON.

On—prep. gov. obj., case *side*.
either—distributive adj. qual. *river*.
long—adj. qual. *fields*.
of—prep. gov. obj. case *barley* and *rye*.
thro'—prep. gov. obj. case *fields*.
to— ,, ,, ,, *Camelot*.
many-towered—adj. distinguishing *Camelot*.

2. Personal pronouns must agree with the nouns for which they stand in gender and number. Give examples of this agreement.

Tom took Mary upon the ice,
It broke and *she* fell in.
He got a rope and in a trice
He pulled *her* out again.
If *they* had both been drowned, you know
Folks would have said, 'I told you so.'

3. Prepositions relate the words they govern, sometimes to a noun, sometimes to a verb, sometimes to an adjective, in the sentence. Show to which the preposition relates the word governed in each of the following:—

(*a*) He is not guilty of the crime.
(*b*) The river in that valley has overflowed.
(*c*) The clouds float across the sky.
of relates the noun *crime* to the adjective *guilty*.
in ,, ,, *valley* ,, ,, noun *river*.
across ,, *sky* ,, ,, verb *float*.

Geography.

1. Draw a map of the Adriatic Sea, and describe the countries on each side of it. Insert the lines of latitude and longitude.

The countries on each side are Italy, Austria, and Turkey. Italy is highly favoured by nature in climate and soil, but agriculture is in a very backward state. Rice, wheat, and oats

grow abundantly on the plains of the Po; the grape, olive, and fig throughout the Peninsula; and oranges on the southern seaboard. It is divided into sixty provinces. Since 1866 the Peninsula with the islands of Sardinia and Sicily form one State, the kingdom of Italy. The States of the Church, formerly under the government of the Pope, were taken possession of in 1870, and since 1871 Rome has been the capital of the country. The Peninsula is traversed through its whole length by the Apennines. *Austria*, or the Austro-Hungarian Monarchy, has under its dominion a great variety of people and races, and consists of (1) The German provinces. (2) The Slavonian provinces. By the Treaty of Berlin, 1878, Bosnia and Herzgovina are now placed under Austrian occupation and administration. The principal river is the Danube, with many tributaries, and the Carpathians are the chief range of mountains.

Turkey is a mountainous country with a fine climate and fertile soil, but agriculture is neglected. Roses and other aromatic plants are cultivated for the manufacture of perfumes. The chief mountains are the Balkans. By the Treaty of Berlin, Roumania, Servia and Montenegro were constituted independent countries.

2. Describe minutely the course of the Danube.

The Danube from the heights of the Black Forest, in Baden, flows eastward through Hohenzollern, Wurtemburg, Bavaria, Austria, east and south through Hungary, and enters Turkey at Belgrade; it continues east through Turkey, separating Servia from Hungary and Bulgaria from Wallachia, and falls into the Black Sea below the town of Ismail. It receives on the right bank the Iller, Leck, Iser, Inn, all from the Tyrolese Alps, the Drave from Tyrol, and the Save from Carinthia; on its left bank the Naab from the Bohemer Wald, the March from Moravia, and the Waag from the borders of Silesia, and the Theiss from the Carpathian Mountains. In Turkey it receives the Morava, the Isker, the Sereth, and the Pruth.

History.

1. Give the dates of Ethelbert, Alfred the Great, Edgar, and Hardicanute.

Ethelbert reigned from 860 till 866.
Alfred „ „ 871 „ 901.
Edgar „ „ 959 „ 975.
Hardicanute „ „ 1040 „ 1042.

2. Tell when Henry I., Richard I., Edward I., and Mary I. ascended the throne; and name their immediate successors.

		A.D.		
Henry I. ascended the throne		1100;	and was succ. by	Stephen.
Richard I.	„ „	1189;	„ „	John.
Edward I.	„ „	1272;	„ „	Edward II.
Mary I.	„ „	1553;	„ „	Elizabeth.

3. Write out a list of our sovereigns from William III. to William IV. inclusive, with their dates.

		A.D.
William III. Mary II. died 1694,	began to reign	1689.
Anne	„ „	1702.
George I.	„ „	1714.
George II.	„ „	1727.
George III.	„ „	1760.
George IV.	„ „	1820.
William IV.	„ „	1830-1837.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Zuider Zee*.

Write, in small hand, as a specimen of copy-setting, *Have you prayed to-night, Desdemona?*

Music.

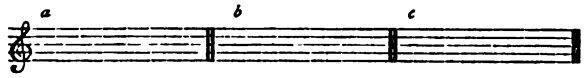
A quarter of an hour allowed for this paper.

1. What is meant by a *sound*, what by a *tone*; and how does a sound differ from a tone?

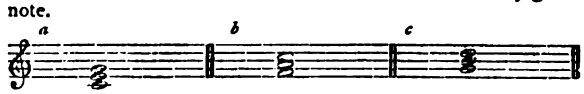
1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) Do, (F) Fa, and (G) Sol.



2. A *triad* is the addition of its third and fifth to any given note.



3. How many tones and how many semitones are found in the diatonic major scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. The population of the world may be taken at 1,456,000,000. Asia contains about 834,710,000 inhabitants; Europe, 315,950,000; Africa, 205,680,000; America, 95,410,000; the Pacific Islands, 4,125,000; and the Polar Regions, 82,000. Give the percentage of the population of the world belonging to each division, to 4 places of dec mals.

$$\frac{1456{,}000{,}000}{100}\begin{cases} :: 834{,}710{,}000 : \frac{83471}{14560} = 57{\cdot}3289 \text{ p.c.} & \text{(Asia)} \\ :: 315{,}950{,}000 : \frac{31595}{14560} = 21{\cdot}6998 \text{ ,,} & \text{(Europe)} \\ :: 205{,}680{,}000 : \frac{20568}{14560} = 14{\cdot}0263 \text{ ,,} & \text{(Africa)} \\ :: 95{,}410{,}000 : \frac{9541}{1456} = 6{\cdot}5528 \text{ ,,} & \text{(America)} \\ :: 4{,}125{,}000 : \frac{4125}{14560} = {\cdot}2833 \text{ ,,} & \text{(PacificIs.)} \\ :: 82{,}000 : \frac{82}{14560} = {\cdot}0056 \text{ ,,} & \text{(Polar Regions)} \end{cases}$$

2. What is the simple interest for 2 years on £120 5s. at 3½ per cent. per annum?

$$\text{Interest } \frac{£120\ 5s. \times 3\frac{1}{2} \times 2}{100} = \frac{£841\ 15s.}{100} = \underline{£8\ 8s.\ 4\tfrac{1}{2}d.}\ \text{Ans.}$$

3. If I pay 6 per cent. of 90 guineas for a ton of hay, what percentage of 100 guineas shall I pay for 9·75 tons?

1 ton cost $\frac{6}{100}$ of 90 gui. or 5·4 gui.

$\therefore 9\frac{3}{4}$ „ $\frac{5{\cdot}4 \times 39}{4}$ gui.

i.e., 52·65 gui. = $\underline{52\frac{13}{20}}$ p.c. of 100 gui.

4. If a dollar be worth 4·16 shillings, and a franc ·83 of a shilling, and a rupee 1·7916 shillings; what (*a*) decimal, and (*b*) percentage, of a florin is the value of each of those coins?

(*a*) dollar $= \frac{4{\cdot}16}{2} = \underline{2{\cdot}08\frac{1}{3}}$ = dec. of a florin; (*b*) $\frac{4{\cdot}16 \times 100}{2} = \underline{208{\cdot}3}$ p.c.

(*a*) franc $= \frac{{\cdot}83}{2} = \underline{{\cdot}41\dot{6}}$ = dec. of a florin; (*b*) $\frac{{\cdot}83 \times 100}{2} = \underline{41{\cdot}\dot{6}}$ p.c.

(*a*) rupee $= \frac{1{\cdot}7916}{2} = \underline{{\cdot}89583}$ = dec. of a florin; (*b*) $\frac{1{\cdot}7916 \times 100}{2} = \underline{89{\cdot}583\frac{1}{3}}$ p.c.

FEMALES.

1. Simplify $\dfrac{16\frac{1}{2} \text{ of } \frac{1}{17} \div 8\frac{1}{2} \text{ of } \frac{1}{2}}{8\frac{1}{7} \text{ of } 1\frac{1}{2} \div 16\frac{1}{3} \text{ of } \frac{7}{17}}$

Multiplying dividend by $\frac{8}{8}\frac{1}{1}$, and the divisor by $1\frac{1}{2}$ we obtain

$$\frac{1392\times7}{696\times126}\div\frac{98\times3}{194\times7}=$$
$$\left(\frac{1392}{696}\times\frac{7}{126}\right)\times\left(\frac{194}{98}\times\frac{7}{3}\right)=$$
$$\frac{2\times97}{18\times7\times3}=\frac{97}{189}\text{ Ans.}$$

2. If 1 qr. $6\frac{3}{7}$ lbs. of bacon cost £1, what will $\frac{1}{8}$ of $3\frac{3}{4}$ of $\frac{10}{11}\frac{9}{2}$ cwts. cost?

1 qr. $6\frac{3}{7}$ lbs. $= 34\frac{3}{7}$ lbs.
$\frac{1}{8}$ of $\frac{1}{4}$ of 20 lbs. $= 2\frac{5}{8}$ lbs.
$\frac{9}{2}\frac{4}{0}$ lbs. : 25 lbs. :: £1 : cost required
$$\frac{£1\times25\times7}{240}=175\text{d.}=\underline{14\text{s. }7\text{d.}}\text{ Ans.}$$

3. Express the sum of $\frac{1}{3}$ of 7s. $4\frac{1}{2}$d., $\frac{1}{8}$ of $\frac{1}{9}$s. $6\frac{3}{4}$d., and $\frac{1}{11}$ of £7 as the fraction of five and a half guineas.

	s.	d.
$\frac{1}{3}$ of 7s. $4\frac{1}{2}$d. =	2	$5\frac{1}{2}$
$\frac{1}{8}$ of 9s. $6\frac{3}{4}$d. =	4	$9\frac{3}{8}$
$\frac{1}{11}$ of £7 =	11	8
Total sum =	18	$10\frac{7}{8}$

$$\therefore\ \frac{18\text{s. }10\frac{7}{8}\text{d.}}{£5\ 15\text{s. }6\text{d.}}=\frac{2265\frac{7}{8}\text{d.}}{1386}=\frac{1815}{11088}=\underline{\frac{55}{336}}\text{ of }5\tfrac{1}{2}\text{ gui. Ans.}$$

4. What will be the dividend, if the divisor be $89\frac{1}{11}$ and the quotient $735\frac{11}{17}$?

$$\text{dividend} = 89\tfrac{1}{11}\times735\tfrac{11}{17}$$
$$=\frac{1}{1}\frac{9}{1}\frac{8}{2}\frac{1}{1}\times\frac{1}{1}\frac{3}{7}\frac{5}{1}\frac{0}{2}\frac{0}{1}=$$
$$=\underline{65525\tfrac{18}{119}}\text{ Ans.}$$

Grammar.

1. 'Anon
We heard the lion roaring from his den;
We saw the large white stars rise one by one;
Or from the darkened glen
Saw God divide the light with flying flame,
And thunder on the everlasting hills.' —TENNYSON.

(*a*) What are co-ordinate sentences? Show that all the sentences in the above are co-ordinate sentences.
(*b*) Point out all the extensions of the predicate that occur in the above.
(*c*) Point out all the verbs in the infinitive mood that you notice in the above, and show why a verb in the infinitive mood cannot form the predicate of a sentence.

(*a*) Co-ordinate sentences are those which can be used independently of each other. The co-ordinate sentences in the above are, 1. 'Anon we heard the lion roaring from his den.' 2. 'We saw the large white stars rise one by one.' 3. 'From the darkened glen (we) saw God divide the light with flying flame.' 4. (We saw God) 'thunder on the everlasting hills.' These are co-ordinate sentences because each gives a complete thought independent of each other.
(*b*) The extensions of the predicate are:
'Anon' extending 'heard' (*time*)
'from the darkened glen' extending 'saw' (*place*)
(*c*) '*roaring*' = an infinitive, gov. by *heard*.
rise = ,, ,, ,, ,, *saw*.
divide = ,, ,, ,, ,, (*saw*).
thunder = ,, ,, ,, ,, ,,
Since the infinitive mood never takes a subject it cannot form a predicate. Sometimes, however, it asserts of an object as 'We saw *him go*.'

2. Conjunctions may be classified, as simplify collective, causal, adversative, or conditional. Give examples of each kind.

Collective conjunctions are :—and, also, likewise, both . . . and
Causal ,, ,, because, for, seeing that.
Adversative ,, ,, but, however, yet, nevertheless, still.
Conditional ,, ,, if, unless, except, since.

Geography.

Answer *either* Q. 2 *or* Q. 3, *not both*.

1. Draw a full map of that part of British North America which lies between Hudson's Bay and the Pacific Ocean.
Insert the lines of latitude and longitude.

2. Give full notes of a lesson on "The Life of a Settler in Australia," showing from the nature of the country what employments are likely to be open to him.

Employments open to Australian settlers.
1. ANIMALS.—Much of the soil adapted either for *agriculture* or for pasturing cattle and sheep—therefore all connected with farming, such as ploughmen, domestic servants, shepherds, etc., find ready employment. Wool is exported from Victoria, New South Wales, Western Australia, Queensland. The plains of the latter afford pasturage of the richest description, where countless numbers of horses, cattle, and sheep, roam in a half wild state. The principal occupation of the people in the various colonies are those of agriculture and stock-raising. Exporting cattle both dead and alive is a large branch of industry.
MINERALS.—Chief minerals are *gold* and copper.—Coal is also wrought; miners, therefore, find work in nearly all the colonies.—Gold is produced especially in Victoria; New South Wales, where coal is found in inexhaustible quantities.—In these two colonies mining operations give employment to a large fraction of the people.—Copper is found in Victoria, Western Australia, and Queensland, whence it is exported.
VEGETABLES.—South Australia—the granary of the Continent.—*Wheat* and *flour* of this colony being objects of just pride to the settlers.—*Cotton* of Queensland is considered superior to that from any other quarter of the world.—Culture of the *Vine* is a recognised branch of industry in South Australia.
Note.—Persons wanted are those who are willing to earn their bread by the sweat of their brow; labourers of all sorts, who can plough, sow, reap, and fence; artisans, such as carpenters, masons, smiths, brickmakers, wheelwrights, etc.; laundresses, dairymaids, etc.—which information should be drawn from the children after they have been made acquainted with the nature of the country.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What can you tell about Northumbria, Mercia, and Wessex.

Northumbria, Mercia, and Wessex were the chief kingdoms of the Saxon Heptarchy about the year 670; and for a century and a half a continual struggle for supremacy was kept up between their respective kings. Northumbria went gradually to decay under the influence of seditions, usurpations, pestilence, and famine, which resulted in anarchy. Mercia then took the lead for about a century. The greatest of its kings was Offa; but the powerful rulers of Wessex were sometimes more than a match for the kings of Mercia, and finally Egbert, a great and wise monarch, in 827 marched into Mercia and compelled the Mercians to receive him as their lord. Northumbria also submitted, and all the rest of England, including Wales and Cornwall.

2. How did William, Duke of Normandy, come to be King of England?

It is said that Edward the Confessor had promised to make William his successor, and that Harold, William's rival, had sworn to give him his support. Resolving to make good his claim to the crown which Harold had usurped, he collected a mighty host, and built a great fleet to carry it across to England. He prevailed on the Pope to excommunicate Harold, and to send him a consecrated banner. Landing in Sussex, William met Harold and his army at Senlac, near Hastings. After a long and stubborn fight the Normans were victorious, and Harold, being slain, left William Conqueror. He was crowned King on Christmas Day, 1066.

3. Who were the Lollards? What treatment did they receive from Henry IV. and Henry V.?

The Lollards were those who followed the religious doctrines of Wiclif. During the reign of Henry IV. a Statute, called *De heretico comburendo*, was passed which aimed at the Lollards,

and enacted that all heretics refusing to give up their opinions should be delivered over to the civil authorities to be burned alive. A London clergyman named Sawtre was the first to suffer in 1401. Henry V. followed the cruel policy of his father in his treatment of heretical opinions. In his reign Lord Cobham, leader of the Lollards, having, it is said, used threats against the civil powers, was condemned to be burnt. Cobham escaped, and a rising of his followers was crushed. Many were executed as traitors, and Cobham, having again escaped, was seized four years after in Wales, condemned at once by Parliament, and burned.

Composition.

Write full notes of a lesson on *Wheat*.

OBJECTS TO BE SEEN.—Stalk of wheat bearing its ear of seeds—chaff—wheat grains free from chaff—bran—flour—biscuit—or other bread made from flour.

CULTIVATION OF PLANT.—Ploughing—sowing in Spring or Autumn—harrowing—rolling—first appearance of plant—ripe in about seven months after the wheat begins to grow—cutting of plants by scythe—sickle—machine—sheaves collected—and piled with head upwards till thoroughly dry—stacked and kept till required for use.

MANUFACTURE OF WHEAT INTO FLOUR.—Wheat threshed by a flail (*describe*)—or in mills—to separate grain from ear—and shake off husk or *chaff*—grain and chaff *winnowed* (*describe*)—steam power often used for the foregoing purposes—Wheat now taken to mill and ground between two large stones (*describe*)—grain when put in covered with a skin—which comes off unground and called *bran*—bran and flour mixed are whole-meal—bran when sifted leaves flour much whiter—flour made finer and finer by sifting—(*sieves described*).

USES.—Very important article of food—made into many kinds of bread—(*ask for names from class*)—starch—*bran* for feeding horses, cows, etc.—bran and flour make *brown-bread*—straw used for bedding, mattresses, thatching, etc.—chaff also used for same purposes.

WHERE GROWN.—England—Russia—France—United States—New South Wales has the best in the world—Prussia—Egypt—and in most temperate regions—imported in great quantities from various countries to supplement the British Crop.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Zuider Zee*.

Write, in small hand, as a specimen of copy-setting, *Have you prayed to-night, Desdemona?*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. Define *point, superficies, plane angle, figure, square, parallelogram, theorem.*

A *point* is that which has position but no parts or magnitude.

A *superficies* is that which has only length and breadth.

A *plane angle* is the inclination of two lines to one another in a plane which meet together, but are not in the same direction.

A *figure* is that which is enclosed by one or more boundaries.

A *square* is a four-sided figure having all its sides equal, and all its angles right angles.

A *parallelogram* is a four-sided figure whose opposite sides are parallel.

A *theorem* is a proposition in which some geometrical property has to be demonstrated; props. IV. V. VI. etc., of Bk. I. are theorems.

2. To bisect a given rectilineal angle, that is, to divide it into two equal angles. Why is the equilateral triangle described remote from the vertex?

Prop. IX. Bk. I.

The equilateral triangle is to be described *remote* from the vertex, because if described on the *same* side, its vertex might coincide with the vertex of the given angle and then the construction would fail.

3. If two triangles have two angles of the one equal to two angles of the other, each to each, and one side equal to one side, viz., either the sides adjacent to the equal angles in each, or the sides opposite to them; then shall the other sides be equal, each to each, and also the third angle of the one equal to the third angle of the other.

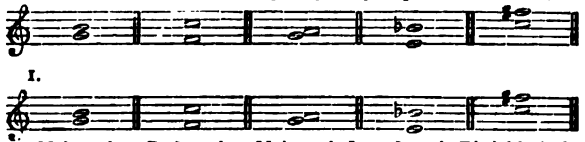
Prop. XXVI. Bk. I.

Needlework.

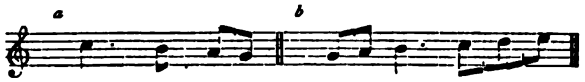
One hour allowed for this exercise.

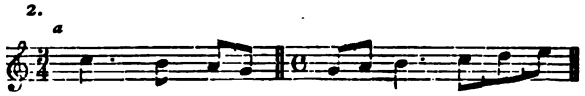
Music.

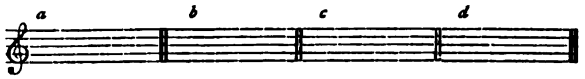
A quarter of an hour allowed for this paper.

1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).

1.

Major 3rd. Perfect 5th. Major 2nd. Imperfect 5th. Diminished 4th.

2. Place before *a* and *b* their time signatures.

2.



3. Write in *a* the scale signature of E♭ (*Me*), in *b* that of A (*La*), in *c* that of G (*Sol*), and in *d* that of F (*Fa*).

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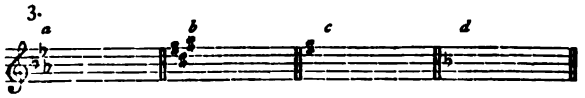

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. 650 children are examined in a school, of whom 28 per cent. fail in arithmetic, 16 per cent in writing, and 12 per cent. in reading. How many children *pass* in each subject?

(*a*) $\frac{72}{100}$ of 650 $= \frac{650 \times 72}{100} = \underline{468}$ pass in Arithmetic.

(*b*) $\frac{86}{100}$ of 650 $= \frac{650 \times 86}{100} = \underline{559}$ „ Writing.

(*c*) $\frac{88}{100}$ of 650 $= \frac{650 \times 88}{100} = \underline{572}$ „ Reading.

2. What principal should be put out at 3½ per cent. simple interest for 5 years in order to produce an amount of £173 18s.?

Amount of £100 for 5 years at 3½ p.c. = £117½

∴ £117½ : £173 18s. :: £100 : principal required.

$$\frac{£100 \times 3478}{2351} = \underline{£148}. \quad \text{Ans.}$$

3. A merchant bought wines at 30s., 40s., and 50s. per dozen. These he mixed in the proportion of 5, 4, and 3, and sold the mixture at 57s. 6d. per dozen. What was his gain per cent.?

	s.	s.
5 doz. @	30	= 150
4 „ @	40	= 160
3 „ @	50	= 150
∴ the 12 doz.		= 460

and prime cost of 1 doz. = 38s. 4d. which being sold for 57s. 6s. gives a profit of 19s. 2d. or $33\frac{1}{3}$ p.c. Ans.

Note.—19s. 2d. = ⅓ of 57s. 6d

4. Which is the best offer, and by how much, in exchange for a horse,—5 cwt. 1 qr. 23 lbs. of an article worth 7½d. per lb., or ½ per cent. on a contract of £16,000?

	£	s.	d.
(*a*) £16,000 @ ⅛ p.c. = ⅛ of £160	= 20	0	0
(*b*) 5 cwt. 1 qr. 23 lbs. @ 7½ per lb. = 611 @ 7½d. =	19	1	10½
(*a*) is better than (*b*) by	18	1	1½

FEMALES.

1. Reduce 7 minutes to the decimal of a day, and divide £10 11s. 3d. by 29·25.

(*a*) $\frac{7 \text{ minutes}}{24 \text{ hours}} = \frac{7 \text{ min.}}{144 \text{ min.}} = \underline{\cdot 004861}$. Ans.

(*b*) $\frac{£10\ 11s.\ 3d.}{29{\cdot}25} = \frac{£42\ 5s.}{118} = \frac{237}{118}s. = \underline{7s.\ 2\frac{3}{4}d.}$ Ans.

2. Find the value of ·76809 of 3 mls. 4 fur.

·76809
3⅛
384045
230427
2·688315 mls.
8
5·50652 fur.
40
20·2608 po.

2 mls. 5 fur. $20\frac{2}{8}\frac{1}{3}\frac{3}{2}$ po. Ans.

3. Find the cost of 3 hhds. of sugar, each weighing 11 cwt. 3 qrs. 10·12 lbs., at the rate of 72·76 shillings foe 1·6 cwt.

(*a*) 11 cwt. 3 qr. 10·12 lbs. × 3 = 1326·12 lbs. × 3 = 3978·36 lbs.
(*b*) 1·6 cwt. = 179·2 lbs.
(*c*) 179·2 : 3978·36 :: 72·76s. : cost required.

$\frac{72{\cdot}76s. \times 3978{\cdot}36}{179{\cdot}2} = \frac{\cdot 289465{\cdot}4736}{179{\cdot}2} =$

1615·32+s. = £80 15. 3·8d. Ans.

4. Simplify—

$$\frac{2{\cdot}048 \times {\cdot}072}{{\cdot}64 \times {\cdot}0009} \times \frac{54{\cdot}045 \times 12}{81 \times {\cdot}036}$$

$$\frac{2{\cdot}048}{{\cdot}64} \times \frac{{\cdot}072}{{\cdot}036} \times \frac{54{\cdot}045}{{\cdot}0009} \times \frac{12}{8{\cdot}1} =$$

$$3{\cdot}2 \times 2 \times 60050 \times \frac{4}{2{\cdot}7} =$$

$$\frac{15372800}{27} = \underline{569362{\cdot}962}. \text{ Ans.}$$

Grammar.

1. 'Now, my co-mates, and brothers in exile,
Hath not old custom made this life more sweet
Than that of painted pomp? are not these woods
More free from peril than the envious court?'
SHAKESPEARE.

(*a*) Analyze the last sentence in the above.
(*b*) Parse all the words in the second and third lines of the above.

(*a*)
'woods' ... ... *subject.*
'these' ... ... *enlargement of subject.*
'are not' ... ... } *incomplete predicate.*
'more free from peril' } *completion of predicate.*
'than the envious court
(is free)' ... ... *adv. clause (of comparison) to predicate.*

(*b*) *Hath*—aux. verb 3rd pers. sing. forming with *made*—pres. perf. indic. of irreg. verb *make, made, made,* agr. with subj. *custom.*
not—adv. of negation mod. *hath made.*
old—adj. pos. deg. qual. *custom.*
custom—abstr. noun, neut. sing., nom. to *hath.*
this—demonstr. adj. pointing to *life.*
life—abstr. noun neut. sing. obj. gov. by *made.*
more—adv. of deg. mod. *sweet*, forming compar. deg.
sweet—predicative adj. qual. *life.*
than—subord. compar. conj. introducing subord. clause.
that—demonstr. pron. referring to *life*, neut. sing. nom. to (is).
of—prep. gov. obj. case *pomp.*
are—irreg. subst. verb. *am, was, been*, indic. pres. indef. 3rd pers. plur. agr. with *woods.*
not—adv. of negation mod. *are.*
these—demonstr. adj. pointing to *woods.*
woods—com. noun, neut. plur. nom. to *are.*

2. Give an example of—

(*a*) A simple sentence.
(*b*) A complex sentence containing a principal and an adjective sentence.
(*c*) A complex sentence containing a principal and an adverbial sentence.
(*a*) I have written a simple sentence.
(*b*) The sentence that is here written is a complex sentence.
(*c*) Can you analyze a complex sentence when you meet one?

3. Write out five words, each compounded of one of the following Latin prepositions, ex, sub, super, trans.

(*a*) *ex*tract, *ef*fect, educe, *ec*centric, *es*cape.
(*b*) *sub*tract, *suf*fer, *sus*pect, *suc*ceed, *sur*rogate.
(*c*) *super*intend, *sur*face, *super*ior, *sur*tout, *sir*loin.
(*d*) *trans*late, *traj*ect, *tres*pass, *trans*it, *traf*fic.

Geography.

1. Draw a full map of the coast-line, from Singapore to the northern end of the Sea of Japan, including the islands near the coast. Insert the lines of latitude and longitude.

2. Give full notes of a lesson on 'A Voyage from Cape Town to Suez and Brindisi,' followed by a railway journey from Brindisi to Paris and Dieppe.

APPARATUS.—Maps of Africa, and Europe or better, a sketch of the voyage made on blackboard as the lesson is given.

ROUTE TO SUEZ.—Starting from Cape Town, capital of Cape Colony, steam or sail N.E. with no good port of refuge in case of storm till we reach the magnificent natural harbour of Delagoa Bay—past Cape Corrientes, Sofala Bay—through the channel of Mozambique with whose southwest current we have to contend—along the low coast of Zanzibar—and the wild and desert coast of the Gallas and Somali to Cape Guardafui, the most eastern point of Africa. Our course is westward to Aden in the Straits of Bab-el-mandeb, the entrance to the Red Sea—whose coasts present nothing but precipitous gulleys, barren sands, and inaccessible cliffs. In passing up the Red Sea we have Arabia on the right and Abyssinia, Nubia, and Egypt on the left—observe the peninsula of Sinai before we arrive at Suez our first destination.

SUEZ TO BRINDISI.—Resuming our voyage at Suez, the entrance to the 'Canal' on the south we are safely floated for 100 miles to Port Said at the northern or Mediterranean entrance—continue in a north-westerly course through the Mediterranean to the Adriatic and reach Brindisi on the east coast of Italy.

On this part of the voyage reference may be made to the 'Canal,' Egypt, Alexandria, Cairo, the Pyramids, and the Nile, to Cyprus, and the general character of the Mediterranean.

Brindisi to Paris and Dieppe.—Having reached Brindisi our journey is continued by rail along the coast of the Adriatic to Ancona, a steamboat-station—thence to Turin, via Bologna, Modena, Parma, and Milan. *Remarks to be made on the view of the sea from the carriage and the towns passed.*

Between Turin and Chambery we pass through the Mont Cenis Tunnel (*here to be described*). Leaving Italy we cross the whole breadth of France, past Lyons to Paris (*description*), and thence to Dieppe viâ Rouen. From Dieppe the passage may very pleasantly be made to Newhaven.

SECOND PAPER.

History.

Two hours and a half allowed.

1. Who was Lady Jane Grey? Tell her married name examine her claim to the crown.

1. Lady Jane Grey was the great grand-daughter of Henry and the daughter of the Duke of Suffolk.

Her married name was Lady Guildford Dudley. Edward VI. bequeathed to her the crown, but Mary, the daughter of Henry VIII. was the rightful heir.

2. How was the succession settled at the death of Elizabeth? Give the date of that event and the length of her reign.

At the death of Elizabeth the crown went to James VI. of Scotland, whose great grandmother (Margaret) was the eldest daughter of Henry VII.

This took place in 1603, after Elizabeth had reigned 44 years.

3. What was the Darien Scheme? Explain the Scotch 'Act of Security,' to which its failure gave rise.

During the greater part of the reign of William III., the Scotch complained of the way in which the English Parliament hampered Scottish trade, and as one means of pacifying Scotland, the King's Commissioner to the Parliament offered to promote emigration. William Paterson, who founded the Bank of England, started *the Darien scheme* for the colonization of Panama. It however resulted in wide-spread ruin on account of the jealousy of the English and Dutch trading companies. In 'Act of Security,' was passed in the Scotch Parliament providing that if Anne died childless the same sovereign should not be chosen to rule over Scotland and England unless the commercial equality of the two kingdoms were secured.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Euxine Sea.*

Write in small hand, as a specimen of copy-setting, '*Have you prayed to-night, Desdemona?*'

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. Parallelograms upon the same base, and between the same parallels, are equal to one another.

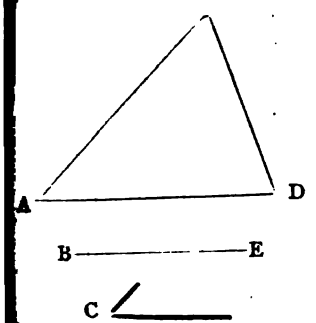
Prop. XXXV., Bk. I.

2. To describe a parallelogram equal to a given rectilineal figure, and having an angle equal to a given rectilineal angle.

Prop. XLII., Bk. I.

3. Construct a triangle having given two sides and an angle opposite one of them; and show that there may, according to circumstances, be two solutions, one or none.

3. Let AD, and BE, be the two given sides and C an angle opposite to one of them, and since C may be either opposite to the less or the greater of the two sides there will be two solutions. First take C to be opposite the less BE.



Make at the point A in AD an angle DAF equal to C (I. 23), and from D with the distance BE, draw a circle cutting AF in F. (*If DF be not long enough to cut AF then the solution fails.*) The triangle AFD is the triangle required.

(A similar construction gives the problem if the angle C be taken opposite the greater AD.)

Because DF = BE, and the angle DAF was made equal to the angle C then DAF is the triangle required.

Of course there is only one solution when it is specified which side the given angle is opposite.

Algebra.

MALES.

Answer Q. 3, and either Q. 1 or Q. 2.

1. Show that $(5a-x)^3-(a-5x)^3=4(a+x)\{31(a-x)^2+$

(a) $\{(5a)^3-3(5a)^2x+3(5a)x^2-x^3\}-\{a^3-3a^2(5x)+3a(5x)^2-(5x)^3\}=$
$(125a^3-75a^2x+15ax^2-x^3)-(a^3-15a^2x+75ax^2-125x^3)=$
$124a^3-60a^2x-60a^2x+124x^3=$ value of left side.

(b) $4(a+x)\{31(a-x)^2+16\}=4(a+x)\{31a^2-62ax+31x^2+16ax\}$
$=(4a+4x)(31a^2-46ax+31x^2)$
$=124a^3-184a^2x+124ax^2+124a^2x-184ax^2+124x^3$
$=124a^3-60a^2x-60ax^2+124x^3$
$=$ val. of right side.

$\therefore$ each side $=124a^3-60a^2x-60ax^2+124x^3$.

2. Find the G. C. M. of—
$6a^4b-17a^3b^2+14a^2b^3-3ab^4$ and $2a^4+3a^3b-9a^2b^2$.

Eliminating ab from the first, and a^2 from the second, we have

$6a^3-17a^2b+14ab^2-3b^3$ and $2a^3+3ab-9b^2$

$2a^3+3ab-9b^2)\ 6a^3-17a^2b+14ab^2-3b^3\ (3a-13b$
$6a^3+9a^2b-27ab^2$
$-26a^2b+41ab^2-3b^3$
$-26a^2b-39ab^2+117b^3$
$80ab^2-120b^3$

$2a-3b)\ 2a^2+3ab-9b^2\ (a+3b$
$2a^2+3ab-9b^2$

$\therefore a(2a-3b)=2a^2-3ab$ is the G. C. M. (a being a measure of ab and a^2).

3. Solve the equations:—

1. $x(x-5)+3(1-x^2)=8-2x^2$.

2. $\frac{x-1\frac{1}{2}}{2}-\frac{2-6x}{13}=x-\frac{5x-\frac{1}{2}(10-3x)}{39}$

Explain, as to a class, each step in the solution of 1.

1. $x(x-5)+3(1-x^2)=8-2x^2$

Multiply x into $x-5$ and 3 into $1-x^2$ to clear away brackets, then $x^2-5x+3-3x^2=8-2x^2$

Now since '*equal quantities may be added or subtracted from equal quantities without destroying the equality of the sums or remainders,*' then '*any quantity may be transferred from one side to the other without affecting the result, the sign of such quantity being changed.*'

therefore $x^2-3x^2+2x^2-5x=8-3$

collecting the quantities $-5x=5$

Now '*if equal quantities be multiplied or divided by equal quantities, the products or quotients shall be equal.*'

therefore dividing each side by -5 we obtain $x=-1$. Ans.

2. Multiply each side by 156

$78x-153-24+72x=156x-20x+10-3x$

$78x+72x-156x+20x+3x=153+24+10$

$173x-156x=187$

$17x=187$

$x=11$. Ans.

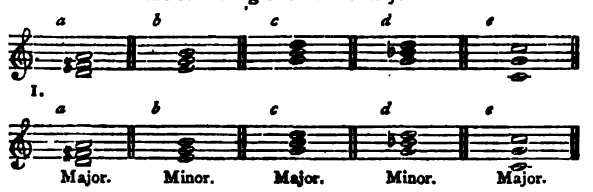
Needlework.

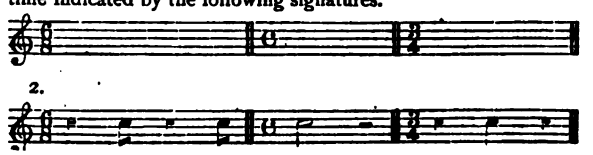
FEMALES.

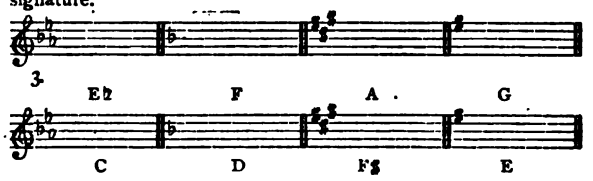
One hour allowed for this Exercise

Music.

A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* 1st *May,* 1878; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. A speculator investing in the 3½ per cents. obtains 4 per cent. for his money after paying ⅛ per cent. for brokerage. At what rate does he buy in?

4 : 3½ :: 100 : price of stock.

$$\frac{£100 \times 13}{4 \times 4} = 81\tfrac{1}{4}$$

$81\frac{1}{4} - \frac{1}{8} = \underline{81\frac{1}{8}}$ price to the speculator.

2. What is the average rate of interest per cent. per annum in the following 4 investments:—£50 yielding £2 10s. in six months, £95 yielding £2 7s. 6d. in 3 months, £1100 yielding £45 7s. 6d. in 12 months, and £200 yielding 6 guineas in 9 months?

	£		£			£		£	
If	50	yields	2·5	in	6 mos.,	then	100	yields	10 in a year.
,,	95	,,	2·375	,,	3 ,,	,,	,,	10	,,
,,	1100	,,	45·375	,,	12 ,,	,,	,,	4·125	,,
,,	200	,,	6·3	,,	9 ,,	,,	,,	4·2	,,

i.e., £400 at the various rates yield 28·325 ,,

∴ £100 yields $\underline{7\frac{1}{160}}$,, Ans.

3. £10,000 in 3½ per cents. is left, free of legacy duty, to an almshouse for the support of 13 bedesmen. This sum is sold out and reinvested in 4 per cents. at par, legacy duty and transfer expenses amounting to 1½ per cent. The bedesmen, when the arrangements are completed, receive each £25 2s. $5\frac{7}{13}$d. a year. What was the selling price of the 3½ per cents.?

(*a*) £25 2s. $5\frac{7}{13}$d. × 13 = £326·6 = interest from new investment.

(*b*) £100 brings 4 ∴ £326·6 is got from $\frac{326\cdot6 \times 100}{4} = £8165$ sum invested in 4 per cents.

(*c*) On account of expenses, etc., 88¾ is left from £100 for re-investment.

∴ Selling price of the 3½ per cents. = $£\frac{8165}{100} \times \frac{100}{88\frac{3}{4}} =$

$£8165 \times \frac{4}{355} = \underline{£92}$. Ans.

4. If gold can be beaten out so thin that a grain of the metal will form a leaf of 56 square inches, how many of these leaves laid one upon the other would make a block one inch thick, the weight of a cubic inch of gold being 10 oz.?

When finished the block = 56 cubic. inch.

,, ,, = 56 times 10 oz.

,, ,, = (56 × 10 × 480) grains.

,, ,, = 268.800 grs. = No. of leaves.

5. If the interest on a loan for 5 months at the rate of 3¾ per cent. per annum be equal to the square root of £·167281, what is the amount of the loan?

$\sqrt{\cdot167281} = £\cdot409$ = interest on loan.

£3¾ : £·409 } :: £100 : amount of loan.
5 mos. : 12 mos. }

$$\frac{£100 \times \cdot409 \times 12 \times 4}{15 \times 5} = £26\cdot176 = \underline{£26\ 3s.\ 6\ \tfrac{8}{125}d.}$$

FEMALES.

1. From what principal did £273 15s. arise in a year at 4½ per cent.?

£4½ : £273¾ :: £100 : principal sought.

$£100 \times \frac{1095}{11 \times 4} = \underline{£6083\ 6s.\ 8d.}$

2. A man divides £1280 among his three children, so that their portions are as 5, 3, 2 respectively. How much does each receive?

5 + 3 + 2 = 10 ∴ the shares are $\frac{5}{10}$, $\frac{3}{10}$, $\frac{2}{10}$ of £1280 = £640; £384; and £256. Ans.

3. A man invests £2340, and makes £2587 of it. What does he gain per cent.?

£2340 gains (£2587 − £2340) = £247

∴ £2340 : £100 :: £247 : gain p. c.

$$\frac{£247 \times 100}{2340} = £\frac{95}{9} = \underline{10\tfrac{5}{9}}.$$ Ans.

4. How much stock in the 4 per cents. can be purchased for £1240 when the price is 89¾?

89¾ : £1240 : £100 : stock required.

$£100 \times 1240 \times \frac{4}{359} = £\frac{496000}{359} = \underline{£1381\ 12s.\ 3\frac{242}{359}d.}$ Ans.

Grammar.

1. 'I know a counsellor and secretary, *that* never came to Queen Elizabeth of England with bills to sign, but he would always first *put* her into some discourse of state, *that she might the less mind the bills.*' —BACON'S ESSAY ON CUNNING.

(*a*) Analyze the above, taking care to show the character of each sentence.

(*b*) Parse the words in italics.

(*c*) Make a short sentence, in the style of the present day, in which the word *but* shall be used in the same manner as in the above.

(*a*)

Sentences.	Kind.	Subject.	Predicate.	Object.	Extensions.
(1) I know a counsellor and secretary	Principal	I	know	a counsellor and secretary	
(2) that never came to Queen Elizabeth with bills to sign,	Adjective to 'secretary'	that	came		to Queen Elizabeth of England (*place*) never (*time*) with bills to sign (*accomp. circumstances*)
(3) but he would always first put her into some discourse of state,	Adv. of *condition* to 'came'	(but) he	would put	her (direct) into some discourse of state (*complement*)	always first (*time*)
(4) that she might the less mind the bills.	Adv. of *purpose* to (3)	(that) she	might mind	the bill	the less (*degree*)

(*b*) *that*—simple rel. referring to 'secretary,' 3rd pers., sing., mas., nom. to *came*;

put—trans. verb, irreg. *put, put, put,* infinitive, pres. indef. gov. by *would.*

that—conj. of purpose (= in order that) introducing subord. adv. sentence.

she—personal pron., referring to Elizabeth, 3rd pers. sing. fem. nom. to *might.*

might—aux. verb, defect. *may, might,* forming the infin.

find—of irreg. trans. verb, *find, found found,* subj. past indef., 3rd pers. sing. agreeing with *she.*

the—the A. S. instrumental inflexion used before comparatives.

the less—adv. phrase of deg. mod. *might mind.*

the—def. art. or disting. adj. pointing to *bills.*

bills—ccm. noun, neut. plur., obj. gov. by *mind.*

(*c*) He never appears, but quarrels follow.

2. What class of English verbs are all of Saxon origin?

(1) *Auxiliary* verbs and (2) all verbs of the *strong* or *irregular* conjugation:—as (1) *may, might; can, could; shall, should;* (2) *put, put, put; leave, left, left; see, saw, seen.*

3. Give some account of the derivation of the verbs *defend*, *accept*, and *baptize*; and mention, if you can, other verbs of the same kind.

Defend is derived from the Latin *de*, from, and *fendere*, to keep off; *accept* from L. *ad* to, and *ceptum*, received; others of the same kind are—*impose*, *refer*, *accede*, *profess*.

Baptize is derived from Gr. *baptizo*, I make to dip; others are *economize*, *paralyze*, *stigmatize*, *climatize*.

Geography.

1. Draw a full map of that part of British North America and the United States which lies to the west of the 90th meridian of West Longitude. Insert the lines of latitude and longitude.

N.B.—The 90th meridian passes through the mouths of the Mississippi.

2. Give full notes of a lesson on 'The Atlantic Ocean.'

THE ATLANTIC OCEAN.

Apparatus.—A map of the Atlantic, or a sketch on black-board to be filled in as the lesson proceeds.

I. SHAPE, BOUNDARIES, AND EXTENT.—Canal-shaped—sometimes called 'Atlantic Canal'—sides nearly parallel—projections on one side standing opposite indentation on the other—about 1,000 miles long—separates Old World on east from the New on the west—connects Arctic with the Antarctic—breadth varies from 900 miles between Norway and Greenland to over 4,000—area, more than 35 million square miles—divided into North and South Atlantic. Average depth about 2,500 fathoms.

II. ISLANDS.—Distinguished from all the other oceans by the fewness of its islands. Principal groups on E. side of N. Atlantic:—Gt. Britain and Ireland, Faroe Is., Channel Is., Canary, Madeira, and C. Verd Is., Azores, Is. in Gulf of Guinea. On W. side:—Newfoundland, Cape Breton I., and Prince Edward's I., Bermudas, Bahamas, and West India Is.—S. Atlantic remarkably free from islands. On E. side are none of any importance—in open ocean are St. Helena, Ascension, and Tristan d' Acunha. On W. side—Falkland Is., opposite S. extremity of S. America, which extremity consists of a cluster of islands called Tierra del Fuego.

III. BRANCHES.—Baltic, North Sea, Irish Sea, English Channel, Bay of Biscay, Mediterranean, G. of Guinea, on the east side; Hudson Bay, G. of St. Lawrence, G. of Mexico, Caribbean Sea, on the west.

IV. RIVER SYSTEMS.—Principal rivers from Old World:—Rhine, Loire, Tagus, Rhone, Po, Danube, and Don; Nile, Senegal, Niger, Congo, Orange. From New World:—St. Lawrence, Mississippi, Rio Grande del Norte; the Orinoco, Amazon, and Rio de la Plata.

V. CURRENTS.—Equatorial current flowing from coast of South Africa to the Caribbean Sea—celebrated Gulf Stream—leaves Gulf of Mexico, flows through Straits of Florida, and runs 3,000 miles northwards, and has an effect even on the climate of Britain (*the value of this remarkable current to be explained*)—*Grassy Sea* is caused by the nearly stagnant water in centre of the revolving current.

VI. WINDS.—Trade-winds blow regularly in the tropical region—beyond the limits of Tropics winds are variable.

Note.—Mention might be made of the Telegraph Cables connecting Europe and America, with remarks on the general character of the configuration of the bed of the Atlantic.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What do you understand by a 'disputed succession'? Mention instances since the Norman Conquest, with their dates, and explain the effects upon the people.

When two or more claimants for the throne appear, and head parties strong enough to support their claims, the succession is said to be disputed.

For example, Henry I. seized the English crown on the death of Rufus (1100) during the absence of his brother Robert, who had the strongest claim. However, Henry was allowed to keep the throne by pleasing the mass of the people. For this purpose he promised that some of the old English laws should be restored, that the barons should be bound to do justice to their dependents, and that the church should no longer be plundered by the king. His wars with his brother Robert, and the conquest of Normandy, caused the Normans of England to regard themselves more and more as English, and to look on the Normans of Normandy as foreigners.

In 1135 the succession was disputed by Stephen, grandson of the Conqueror, and Matilda, daughter of Henry I. Stephen became king, and during the whole of his reign, although he meant well, had no power, except over his army, and could hardly be said to govern at all; justice was totally neglected; his reign was a time of universal confusion, fighting, plundering, starvation, and misery indescribable.

2. When were the supplies voted by Parliament first appropriated to particular purposes? Show the importance of this change.

In the reign of Charles II. 1665, the House of Commons voted a sum of money on the condition that it should be spent in carrying on the Dutch war, and for no other purpose. Suspecting that Charles, notwithstanding this proviso, had not spent the money as had been directed, the Commons instituted an inquiry, which resulted in the discovery of great abuse of trust and misapplication of funds. The result of this experience was a more jealous watchfulness on the part of the Commons over the national expenditure, which has gradually developed into the system of the present day, in accordance with which every penny is voted for a certain purpose, and for no other.

3. When did George IV. ascend the throne? Account for the national distress which marked the early years of his reign.

George IV. ascended the throne in 1820. The national distress at the beginning of his reign was caused by the restrictions placed upon trade, as well as by the heavy taxation consequent upon the long European War. The scarcity caused by a series of bad harvests was intensified by the landowners, who kept their corn till it had reached famine prices. Society was also disturbed by the great changes of employment after the war, the riots against machinery by the Luddites, and the distress of the rural poor, which brought about a rapid increase of crime.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Zuider Zee*.

Write, in small hand, as a specimen of copy-setting, '*Have you prayed to-night, Desdemona?*'

Composition.

Write a short essay on *Different modes of artificial lighting*.

In this country, when the short winter day is cheered by only a few hours of the sun, it is an absolute necessity to have some means of lengthening the working day by artificial methods.

In cities, towns, and even in many villages, this is effected by gas, manufactured from coal. Some of the wealthier cities have recently been experimenting with the electric light, and it is generally expected that it will soon be as much used as coal-gas is now. The lime-light is also made use of in theatres when some particular actor or scene has to be prominently brought out.

In country places, where gas is impracticable, oils of various qualities are burned in lamps, which is a great improvement on the more ancient method of lighting with candles. These are still preferred for cleanliness and safety in many houses, very beautiful ones being manufactured in wax, and a very pretty sight it is to see a room when the light is emitted from a series of handsome candelabra.

It is a usual thing to celebrate some important events, or escort a notable person with a torch-light procession, reminding one of the time when the link-boys expected some remuneration after accompanying a lady or gentleman through the streets of London, in the days when the city could neither boast of oil nor gas.

What a blessing is the lighthouse, with its guiding light to the mariner, when the natural day is ended, and the never-failing beacon warns him of danger, or proclaims to him a haven of refuge!

Euclid.

MALES.

Answer two Questions, including (if possible) Q. 2.

[All generally understood abbreviations for *words* may be used.]

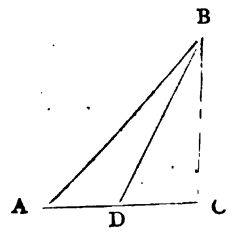
1. If a straight line be divided into two equal parts, and also into two unequal parts; the rectangle contained by the unequal parts, together with the square on the line between the points of section, is equal to the square on half the line.

Prop. V., Bk. II.

2. If a line be drawn from one of the acute angles of a right angled triangle to the bisection of the opposite side, the square on that line is less than the square on the hypothenuse by three times the square on half the line bisected.

Let AC be bisected in D, and join BD, then the sq. on AB is equal to the sq. on BD and three times the sq. on AD (or DC).

Because AC is bisected in D the sq. on AC is obviously equal to four times the sq. on AD or DC, in other words to *three* times the sq. on AD and the sq. on DC.



Now sq. on AB = sqs. on BC, CA (I. 47) that is to the sq. on BC, the sq. on DC, and three times the sq. on AD.

But sq. on BD = sqs. on BC and CD.

Therefore sq. on AB = sq. on BD and three times the sq. on AD or DC.

That is the sq. on D is less than the sq. on AB by three times the sq. on half the line bisected. Q. E. D.

3. If a straight line be bisected, and produced to any point, the square on the whole line thus produced, and the square of the part of it produced, are together double of the square on half the line bisected, and of the square on the line made up on the half and the part produced.

Prop. X. Bk. II.

Algebra.

MALES.

Answer two Questions, including (if possible) Q. 1.

1. If c be a common measure of a and b, it will also measure $ma+nb$ and $ma-nb$, where m, n are any quantities.

Prove that in the ordinary process for finding G. C. M., the result is not affected if at any step we multiply the dividend by a simple factor.

Let c be contained p times in a, and q times in b; then $a=pc$, $b=qc$, and $ma\pm nb=mpc\pm nqc=(mp\pm nq)\,c$; hence c is contained $mp\pm q$ times in $ma\pm nb$, and therefore c measures $am\pm nb$.

To avoid fractional co-efficients in all the terms which occur, we may, without altering the G. C. M. of the expression, multiply by any quantity which does not introduce a new common measure; for the greatest common measure of mD and nD, if m and n have no common measure but unity, is D; and D will also be the Greatest Common Measure of mD and pnD, if p and m have no common measure but unity.

2. Simplify—

$$(1)\quad 5(a+b)^3-5(a-b)^3-20ab(a-b)-10b(a+b)^2.$$

$$\begin{aligned}
5(a^3+3a^2b+3ab^2+b^3) &= 5a^3+15a^2b+15ab^2+5b^3\\
-5(a-b^3) &= -5a^3+15a^2b-15ab^2-5b^3\\
-20ab(a-b) &= -20a^2b+20ab^2\\
-10b(a+b)^2 &= -10a^2b-20ab^2-10b^3\\
\text{adding} &= 10b^3 \quad \text{Ans.}
\end{aligned}$$

$$(2)\quad \frac{1}{9x^2-4y^2}-\frac{3x}{27x^3-8y^3}$$

$$\text{L. C. M.}=(3x-2y)(3x+2y)(9x^2+6xy+4y^2)$$

$$\frac{9x^2+6xy+4y^2-9x^2+6xy}{(3x-2y)(3x+2y)(9x^2+6xy+4y^2)}=\frac{12xy+4y^2}{(3x+2y)(27x^3-8y^3)}=\frac{4y(3x+y)}{81x^4-24xy^3-54x^2y-16y^4}\quad\text{Ans.}$$

3. Solve the equations—

$$(1)\quad \begin{cases} 101x-400y=2\\ 101y-25x=\frac{1}{2}\end{cases}$$

$$\begin{aligned}
101x-400y=2 &= 101x-400y=2\\
-25x+101y=\tfrac{1}{2} &= -100x+404y=2\\
\text{adding} &\quad x+4y=4\\
x &= 4-4y
\end{aligned}$$

Substituting for x in No. 1.

$$\begin{aligned}
404-404y-400y&=2\\
804y&=402\\
y&=\tfrac{1}{2}\quad\text{Ans.}
\end{aligned}$$

Hence $x=2$ Ans.

$$(2)\quad 5x-\frac{3(1-x)}{(3-x)}=2x-\frac{3(2-x)}{(2)}$$

$$\frac{18x-5x^2-3+3x}{3-x}=\frac{4x-6+3x}{2}$$

$$\begin{aligned}
\text{clearing of fractions}\quad & 36x-10x^2-6=27x-18-7x^2\\
\text{transposing}\quad & -10x^2+7x^2+36x^2-27x=6-18\\
\text{collecting}\quad & 3x^2-9x=12\\
\text{dividing by 3}\quad & x^2-3x=4\\
\text{completing square}\quad & x^2-3x+\tfrac{9}{4}=\frac{16+4}{4}=\tfrac{25}{4}\\
\text{taking root}\quad & x-\tfrac{3}{2}=\pm\tfrac{5}{2}\\
\therefore\quad & x=\tfrac{3}{2}\pm\tfrac{5}{2}=4\text{ or }-1\quad\text{Ans.}
\end{aligned}$$

Mensuration.

MALES.

Answer one Question.

1. How long will it take a man to walk round a square field whose area is $5\frac{5}{8}$ acres, at the rate of a mile in $10\frac{3}{4}$ minutes.

$5\frac{5}{8}$ ac. = 27225 sq. yds. area of field.

$\therefore$ side of square = $\sqrt{27225}$ = 165 yds.

and 165×4 = 660 yds. length of boundary.

Wherefore 1760 yds. : 660 yds. :: $10\frac{3}{4}$ min. : time required.

$\frac{43}{4}$ min. $\times\frac{660}{1760}=4$ min. Ans.

2. The radius of a circle is 25 inches, and the angle subtended by an arc at the centre is 32° 31′ 12″·4: find the length of the arc.

circumference = 50 in. × 3·1416 = 157·08 in.

360° = 1296000″

32° 31′ 12″·4 = 117072″·4

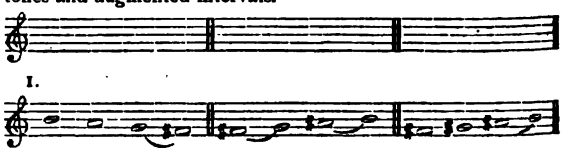
$\therefore$ 1296000″ : 117072″.4 :: 157·08 in. : length of arc.

$$\frac{157\cdot08\text{ in.}\times117072\cdot4}{1296000}=\frac{18389732\cdot592\text{ in.}}{1296000}=14\cdot189\text{ in.}\quad\text{Ans.}$$

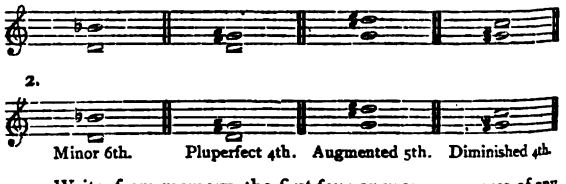
Music.

A quarter of an hour allowed for this Paper.

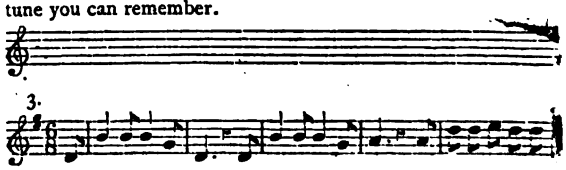
1. Write the upper tetrachord of B (*Si*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.



3. Write, from memory, the first four or more measures of any tune you can remember.



ERRATUM.—The answer to question 3, Standard III., in Recent Inspection Questions in THE PRACTICAL TEACHER for May, should have been £92,010 14s. 5d.

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.

(1) Put down—eight, seven hundred and ten, seventy-one, seven hundred and one, four hundred and fifty-six—add them up. Ans. 1946.

(2) Put down—seven hundred and thirty-two; under it three hundred and forty-five—subtract. Ans. 387.

(3) From two hundred subtract nineteen. Ans. 181.

STANDARD II.

(1) From thirty-six thousand three hundred and nine, take two thousand seven hundred and forty-one. Ans. 33,568.

(2) Multiply eight thousand three hundred and sixty-five, by seven hundred and sixty. Ans. 6,357,400.

(3) Put down—thirty-nine thousand two hundred and fifty-eight—divide by six. Ans. 6543.

STANDARD III.

(1) If 754 be the divisor, and 564,647 be the dividend, what is the quotient? Ans. 748—655.

(2) A's rent for the quarter is £3 17s. 4d., while B's quarterly rent is £5 os. 4d. How much is B's yearly rent more than A's? Ans. £4 12s.

(3) Add together seven hundred and fifty-four pounds twelve and sixpence, sixteen pounds four and twopence halfpenny, four hundred and sixty-nine pounds sixteen and fivepence halfpenny, £14 9s. 6¾d., and £16 14s. 9¾d. Ans. £1271 17s. 6½d.

(4) Take nine thousand and nine pounds fourteen and sixpence halfpenny from £19004 16s. 2d. Ans. £9995 1s. 7½d.

(5) Find the value of 601 farthings, 12 crowns, 642 fourpenny pieces, and £12 4s. 6½d. Ans. £26 11s. o¾d.

STANDARD IV.

(1) Multiply £35 5s. 3¾d., by 99. Ans. £3491 5s. 11¼d.

(2) Divide £94 10s. 6d., by 3067. Ans. 7¼d.—1801.

(3) Supposing there are 51 working hours in a week, and a man gets 6½d. an hour and that his week's wages are £1 5s. 6½d.—what time did he lose? Ans. 3hr. $50\frac{10}{13}$m.

(4) If the cost of carrying luggage is 4s. 2½d. a ton, how many tons can be carried for £1 11s. 6¾d.? Ans. 7⅓ tons.

(5) Reduce $1\frac{3}{4}$ guineas + 14 shillings + 3¾d., to farthings. Ans. 2451 farthings.

STANDARD V.

(1) Find the cost of 2 cwt. 3 qrs. 15 lbs. 5 oz. at £46 8s. 3d. per cwt. Ans. £133 19s. $7\frac{4}{25}\frac{1}{6}$d.

(2) If £2 12s. 6d. be the cost of 408 yards, what would 2 fur. 3 pls. 4½ yds. cost? Ans. £2 19s. $3\frac{57}{68}$d.

(3) If a train starts at 9 a.m. and travels 196 miles by 3.10 p.m.—what was the average distance per hour. Ans. $31\frac{29}{37}$ miles.

(4) What would be the cost of $139\frac{1}{16}\frac{3}{0}$ tons at £1 19s. 11¾d. per ton? Ans, £279 4s. 5½d.

(5) A bill:—1 cwt. of apples at 3½d. a lb., $47\frac{1}{4}$ lbs. of grapes at 8d. a lb. 125 oranges at 10d. a score, ¾ cwt. of potatoes at £5 10s. a ton. Ans. £3 13s. 6d.

STANDARD VI.

(1) Simplify

$$\frac{\frac{1}{6}+\frac{4}{3}+\frac{8}{1}-\frac{11\,6}{3\,6}}{\frac{4\,8\,0}{1\,8\,0}\times\frac{6\,0}{4\,8\,0}} \text{ and } \frac{3{\cdot}009+1{\cdot}091-3{\cdot}957044}{6{\cdot}48}$$

Ans. $4\frac{11}{28}$ and ·022061.

(2) A, B, and C can do a piece of work in 12 days, and A and B can do it in 18 days—in what time could C do it alone? Ans. 36 days.

(3) Simplify 9·99375 tons, and $5\frac{1}{8}$ of 20s. + ¾ of 3 guineas + ⅛ crown. Ans. 9 tons 19 cwt. 3 qrs. 14 lbs. and £7 5s. $0\frac{8}{9}$d.

(4) If a pane of glass measures $2\frac{3}{4}$ feet by $1\frac{1}{2}$, what would be the cost of 8 panes at 14s. 6d. a sq. foot? Ans. £23 4s.

(5) If a 5½d. loaf weighs 4lbs. when wheat is 46s. a quarter, what should be paid for 32 lbs. of bread when wheat is 56s. a quarter? Ans. 4s. $5\frac{1}{7}\frac{1}{3}$d.

Domestic Economy.

STAGE III.—BRANCH I.

(1) How may air and diet affect our health?

(2) Why is cleanliness important in sickness and health?

(3) What precautions are to be taken against infections?

BRANCH II.

(1) Why is extra heat applied at first both in boiling and roasting meat?

(2) How should fish be boiled?

(3) State how you would prepare cauliflower and potatoes for the table.

(4) What system for savings do you prefer and why?

Physiology.

STAGE III.

(1) What is nerve, and what is its appearance in the body?

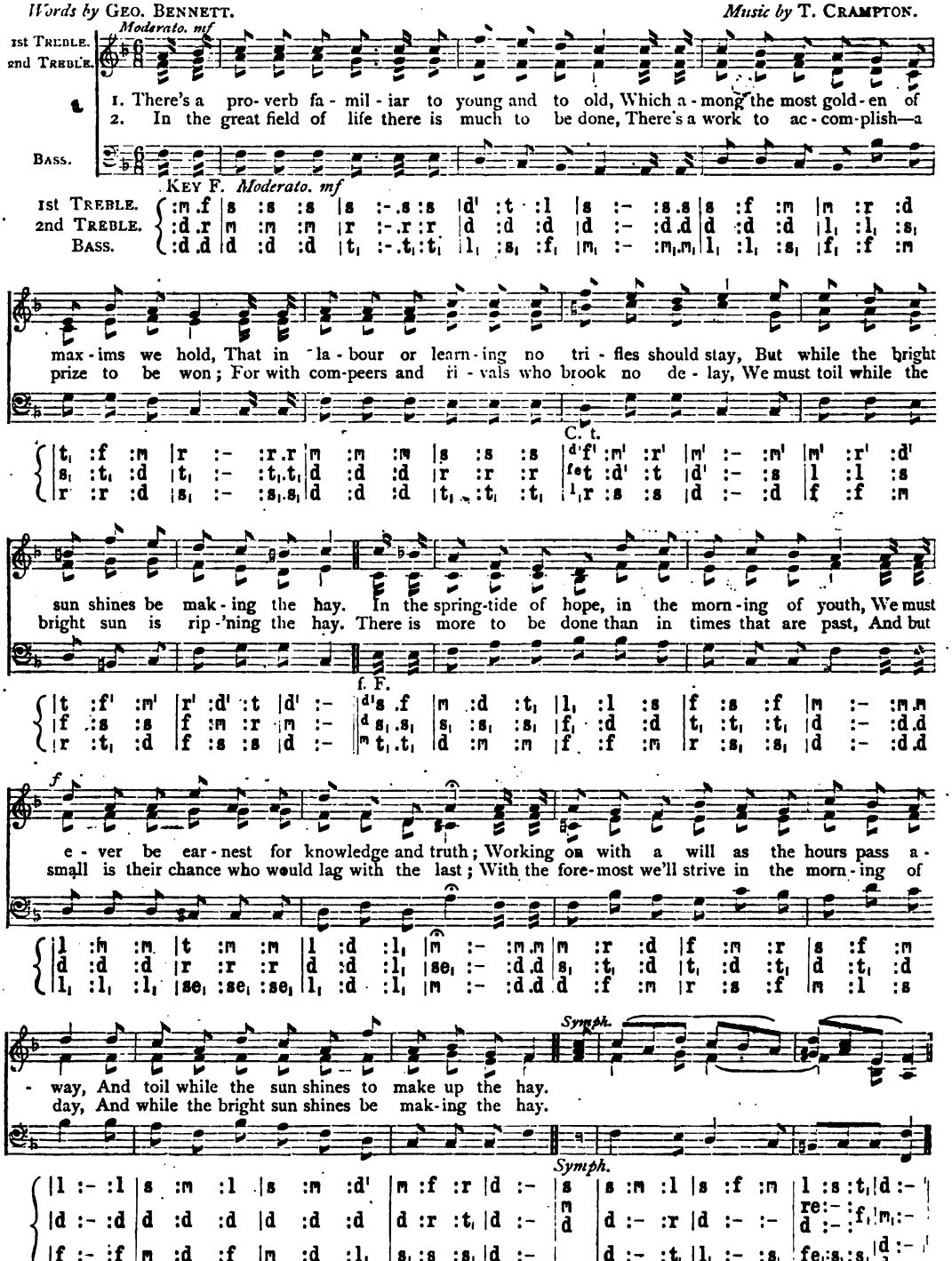
(2) Describe the seat and branches of the nervous system through the human frame.

(3) Account for the effects of cutting through the spinal cord.

(4) Describe the structure of the eye.

MAKE HAY WHILE THE SUN SHINES.

Words by GEO. BENNETT. *Music by* T. CRAMPTON.


1st TREBLE.
2nd TREBLE.
Moderato. mf
1. There's a pro-verb fa-mil-iar to young and to old, Which a-mong the most gold-en of
2. In the great field of life there is much to be done, There's a work to ac-com-plish—a
BASS.
KEY F. Moderato. mf
1st TREBLE.
2nd TREBLE.
BASS.
max-ims we hold, That in la-bour or learn-ing no tri-fles should stay, But while the bright
prize to be won; For with com-peers and ri-vals who brook no de-lay, We must toil while the
C. t.
sun shines be mak-ing the hay. In the spring-tide of hope, in the morn-ing of youth, We must
bright sun is rip-'ning the hay. There is more to be done than in times that are past, And but
f. F.
e-ver be ear-nest for knowledge and truth; Working on with a will as the hours pass a-
small is their chance who would lag with the last; With the fore-most we'll strive in the morn-ing of
Symph.
-way, And toil while the sun shines to make up the hay.
day, And while the bright sun shines be mak-ing the hay.
Symph.

THOMAS DUNMAN.

WE regret to have to announce the death, at the early age of thirty-two, of a promising young Science Teacher and Lecturer—Mr. Thomas Dunman, lecturer on Physiology at the Birkbeck Institution, and physical science lecturer at the Working Men's College, Great Ormond Street, the story of whose brief life furnishes a remarkable instance of what may be done by energy, perseverance, and a strong faith in one's own powers. He had to contend against adverse circumstances from the outset of his career, but his thirst for knowledge, and especially for scientific knowledge, was unquenchable. His early education was limited, but his reading was wide, his memory was one of remarkable power, and he possessed a mental vigour and ability of unusual character. He made himself master of French, Greek, and Latin, and attained considerable proficiency in mathematics and physical science, while working for his living at a most uncongenial occupation, and it was always in spite of his surroundings he went on adding to his stock of knowledge.

About seven years ago he took charge of the physiology class at the Working Men's College in Great Ormond Street, and the attractiveness of his style, the lucidity of his exposition, and the strong personal enthusiasm for his subject, which he imparted to every student, soon made the class one of the largest and most popular in the college, while the practical results, as shown by the examinations at South Kensington, attested to the thoroughness of his teaching.

The like success attended him in other courses of lectures in other branches of science, and it is not too much to say that Mr. Dunman has been greatly instrumental in infusing new life into the admirable institution which Mr. Frederick Denison Maurice founded. At the Birkbeck Institution, too, where he succeeded Dr. Aveling as physiology lecturer, his work was much appreciated, although latterly failing health somewhat interfered with his labours there.

In 1879 he published a very useful 'Glossary of biological, anatomical, and physiological terms,' which has sold well among students, both here and in America; and finding his lectures on popular scientific subjects were so much appreciated, he commenced last year to issue them in pamphlet form. In this way four had appeared. 'The Mechanism of Sensation,' 'The Starlit Sky,' 'Pre-historic Man,' and 'Volcanoes and Coral Reefs.' He contributed to Cassell's 'Science for All,' to Ward and Lock's 'Universal Instructor,' 'Amateur Work,' and several other publications, and his career has been cut short just when it seemed that at last the tide was beginning to turn that would bring the fame and fortune to which his hard work and untiring industry would justly entitle him.

He married early, and the effort to support his family by science teaching and lecturing, may fairly be said to have cost him his life, for whatever he undertook he worked at conscientiously and enthusiastically, and in his teaching especially, he was, as we have said, thorough, hating anything like 'cramming' or 'scamping.' During the past two years there were warnings that his energies were being too strongly taxed, but they were unheeded, and at the beginning of the present year brain troubles became markedly apparent, and he was obliged to give up work. But it was too late, he gradually grew worse, and died on the 9th inst., leaving a widow and two children, for whom he had been unable to make any provision, as will be readily understood by those who have any knowledge of the kind of rewards which in this country fall to those who devote their lives to science.

C. W.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR JUNE, 1882.

EXERCISE V.

(1) $\frac{3b}{2}$. (2) $\frac{35ab}{4}$. (3) $-\frac{3x}{2}$. (4) $-6xy$. (5) $\frac{83ab}{42}$.

EXERCISE VI.

(1) $-10b$. (2) $8abc$. (3) $6xyz$. (4) $8cde$. (5) $-2a+3b-7c$. (6) $20x$ pounds and $4y$ shillings. (7) $\frac{a}{2}$ — (8) $3a+\frac{3}{2}b+2c$. (9) The terms destroy one another. (10) $9(a+b)$.

EXERCISE VII.

(1) $3x+4y+5z$. (2) $3a-5b-6bc+4d$. (3) $9a+5b-3c+2d+e-f$. (4) $15x^2-60y^2-2z^2$. (5) $-5a+4b+c-2d+7$. (6) $4x^2+2a^2+2b^2$. (7) $-3a+10b+5d$. (8) $5a+2b-6c+3d$. (9) $28(a+b)-15(c+d)$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR JUNE, 1882.

(No. 4.)

STANDARD III.

A. 1. 37,722—11.
2. 24,391—19.
3. 13,357—322.

B. 1. 230,436.
2. 10,103—485.
3. 810—171.

C. 1. 26,994—44.
2. £723 14s. 4½d.
3. £26,644 11s. 7d.

D. 1. £643 11s. 4½d.
2. 585,491 farthings.
3. 1692 boys.

E. 1. 17,000 marbles.
2. £62 4s. 7½d. less.
3. 4100—4120.

F. 1. 2049—20,166.
2. £28.343 18s. 0½d.
3. £914 9s. 9d.

ADVANCED EXAMINATION.

1. Boy, 9½d.; girl, 1s.
2. £292 5s. 10d.
3. £761 10s. 10½d.

STANDARD IV.

A. 1. £2061 1s. 6d.
2. £5908 8s. 3¾d.
3. £294 5s. 5¼d.

B. 1. £28,410 4s. 4½d.
2. 129 15s. 11½d.—49.
3. 176,391 lbs.

C. 1. 2¾d.—43,118.
2. 139 tons 16 cwt. 3 qrs. 14 lbs. 14 ozs.
3. £2 5s. 2½d.

D. 1. 111 wks. 14 h. 5m. 17sec.
2. 96 weeks.
3. £7 4s. 1d.

E. 1. 564,537,600 sq. ft.
2. 212 dresses, 3 yds. 1 qr. left.
3. £5677 17s. 5½d.

F. 1. 256,015 mins.
2. £872 2s.
3. 255,636 inches.

ADVANCED EXAMINATION.

1. 342 ton. 3 cwt. 3 qrs.
2. £4 lbs.
3. 84½ lbs.

STANDARD V.

A. 1. £4 5s. 10½d.
2. £50 9s. 4½d.
3. 166 18s. 9¾d.

B. 1. £298 1s. 8d.
2. 4937 2s. 3¾d.
3. 1891 13s. 6½d.

C. 1. £13,784 10s. 2½d.
2. £39,910 7s. 3½d.
3. £90 18s. 7$\frac{7}{10}$d.

D. 1. £32 6s. 11½d.
2. £34 4s.
3. £1297 7s. 11d.

E. 1. £15 10s. 6½d.
2. £332 1s. 6¾d.
3. £331 12s. 2¼d.

F. 1. 2800 marbles.
2. £24 0s. 9$\frac{9}{10}$d.
3. £27 7s. 10½d.

ADVANCED EXAMINATION.

1. £1712 10s. gain.
2. £4213 8s. 8$\frac{87}{140}$d.
3. £48 7s. 10d.

STANDARD VI.

A. 1. $2\frac{1}{4}\frac{2}{3}$.
2. $2\frac{1}{3}\frac{2}{5}$.
3. $2\frac{7}{17}$.
B. 1. 6s. $1\frac{1}{4}$d.
2. 37.665.
3. $\frac{8}{13}$.
C. 1. £20 14s. $4\frac{4}{15}$d.
2. £8 7s. 11d.
3. $14\frac{8}{13}\frac{9}{8}$.
D. 1. £7 12s. 0·5472d.
2. 5 hrs. 8 mins.
3. ·497857142.

E. 1. $3\frac{4}{11}\frac{6}{7}$.
2. $\frac{8}{1}\frac{8}{6}\frac{7}{0}\frac{7}{0}$.
3. £50 8s.
F. 1. 651·348.
2. $\frac{1}{1}\frac{2}{7}\frac{8}{6}$ lbs.
3. £3 9s. $8\frac{4}{15}$d.

ADVANCED EXAMINATION.

1. $19\frac{1}{2}$ hours.
2. £1 5s. 6d. ·6525.
3. $9\frac{1}{1}\frac{0}{8}\frac{8}{3}$ days.

STANDARD VII.

A. 1. £117.
2. £89 13s. 3d.
3. $2\frac{1}{7}$ per cent.
B. 1. £7 2s. $7\frac{8}{8}$d.
2. $2\frac{7}{2}\frac{7}{1}$ years.
3. £357 2s. $10\frac{1}{2}$d.
C. 1. $143\frac{7}{3}\frac{7}{1}$ days.
2. $3\frac{1}{2}\frac{4}{7}$ per cent.
3. Man to boy as 85 to 63.
D. 1. £427 18s. $8\frac{8}{1}\frac{8}{3}$d.
2. £189 12s. $10\frac{8}{1}\frac{8}{3}$d.
3. 177·369+yards.

E. 1. May 19th, at 3-46 a.m.
2. £20 14s. $7\frac{2}{1}\frac{2}{1}$d.
3. $7\frac{7}{1}\frac{7}{7}$d.
F. 1. £600.
2. £843 12s. $11\frac{1}{6}\frac{3}{6}$d.
3. £83 17s. $11\frac{8}{1}\frac{8}{4}\frac{8}{5}$d.

ADVANCED EXAMINATION.

1. 14s. $8\frac{1}{4}$d. a yard.
2. $5\frac{1}{2}$ per cent.
3. £141 7s. $10\frac{1}{2}$d.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR JUNE, 1882.

STANDARD III.

1. $2\frac{1}{2}$d. × 80 = 200d. excess received by girls.
£8 15s. − 200d. = 1900d. to be divided equally among the whole (120 *b.* + 80 *g.* =) 200.
Then 1900d. ÷ 200 = $9\frac{1}{2}$d. a boy's share
and $9\frac{1}{2}$d. + $2\frac{1}{2}$d. = 1s. a girl's share } Ans.

2.
$$(280 - 140) \div 4 = \begin{cases} 140 \text{ at } 4\text{d.} = 560\text{d. a week.} \\ 35 \text{ at } 5\text{d.} = 175\text{d.} \quad ,, \\ 60 \text{ at } 6\frac{1}{2}\text{d.} = 390\text{d.} \quad ,, \end{cases}$$
$$\frac{280 - (140 + 35 + 60)}{3} = 15 \text{ at } 8\text{d.} = 120\text{d.} \quad ,,$$
$$\text{The rest} = \begin{cases} 20 \text{ at } 9\text{d.} = 180\text{d.} \quad ,, \\ 10 \text{ at } 10\text{d.} = 100\text{d.} \quad ,, \end{cases}$$

Total weekly receipts = 1525d.,
and 1525d. × 46 = 70150d. = £292 5s 10d. Ans.

3.

		£	s.	d.
Jan.	receipts amount to	238	14	$7\frac{1}{2}$
Feb.	,, = £238 14s. $7\frac{1}{2}$d. − £79 16s. $0\frac{1}{2}$d. =	158	18	7
Mar.	,, = £158 18s. 7d. − £48 17s. $10\frac{1}{4}$d. =	110	0	$8\frac{1}{4}$
April	,, = £507 13s. 11d. ÷ 2 =	253	16	$11\frac{1}{2}$

Ans. £761 10 $10\frac{1}{2}$

STANDARD IV.

1. $1\frac{1}{4}$ lb. × 500 = 875 lb. of bread eaten daily by men
$1\frac{1}{4}$ lb. × 400 = 500 lb. ,, ,, women
1 lb. × 680 = 680 lb. ,, ,, boys
$\frac{3}{4}$ lb. × 620 = 465 lb. ,, ,, girls
2520 lb. ,, ,, all.

Five lb. of flour makes six lb. of bread, hence (2520 ÷ 6) × 5 = 2100 lb. *flour* consumed daily.
2100 lb. × 365 = 766,500 lb. = 342 ton 3 cwt. 3 qr. Ans.

2. $127\frac{1}{2}$ cwt. = 14,280 lb.
$10\frac{3}{4}$ lb. × 112 × 5 = 6020 lb. eaten by horses.
14280 − 6020 = 8260 lb. eaten by 118 cows in 5 days.
8260 ÷ 5 = 1652 lb. ,, 118 ,, 1 ,,
1652 ÷ 118 = 14 lb. Ans.

3. 2 tons 15 cwt. 0 qr. − 11 cwt. 2 qrs. = 2 tons 3 cwt. 2 qr. = 4872 lb., weight of 56 bags filled with coal.
4872 lb. ÷ 56 = 87 lb. weight of a bag *and* coal.
87 lb. − $2\frac{1}{2}$ lb. = $84\frac{1}{2}$ lb. Ans.

STANDARD V.

1. Total cost = 11000g. + ($1\frac{1}{2}$g. × 500 = 625g.) = 11625g.
300g. × 30 = 9000g., and $22\frac{1}{2}$ × 150 = 3375g.
and 9000g. + 3375g. = 12375g. = £12993 15
£18 10s. × (500 − 450) = £ 925 0

Total selling price 13918 15
Deduct the outlay 11625g. = 12206 5

Ans. £1712 10

2.

		£	s.	d.				
10 cwt. is $\frac{1}{2}$		4	17	8				
				10				
		48	16	8	price of	10 tons.		
				10				
		488	6	8	,,	100 ,,		
				8				
		3906	13	4	,,	800 ,,		
		293	0	0	,,	60 ,,		
		9	15	4	,,	2 ,,		
5 cwt. is $\frac{1}{4}$		2	8	10	,,		10 cwt.	
1 cwt. is $\frac{1}{2}$		1	4	5	,,		5 ,,	
28 lb. is $\frac{1}{4}$		0	4	10	$\frac{1}{2}$,,		1 ,,	
14 lb. is $\frac{1}{8}$		0	1	2	$\frac{1}{1}\frac{3}{0}$,,			28 lb.
2 lb. is $\frac{1}{7}$		0	0	7	$\frac{1}{1}\frac{3}{0}$,,			14 ,,
		0	0	1	$\frac{1}{1}\frac{3}{0}\frac{3}{0}$,,			2 ,,
Ans.		£4213	8	$8\frac{8}{1}\frac{7}{4}\frac{7}{9}$	,,	862	16	44 lb.

3.

		£	s.	d.
7 × 8 × $9\frac{1}{2}$ = 532 hours at 7d. = 3724d. =		15	10	4
10 × 7 × 9 = 630 ,, $6\frac{1}{2}$d. = 4095d. =		17	1	3
6 × 11 × 10 = 660 ,, $5\frac{1}{2}$d. = 3795d. =		15	16	3

Ans. £48 7 10

STANDARD VI.

1. $\frac{15}{21\frac{1}{2}} = \frac{30}{43}$ fraction of the coat done by A.
$1 - \frac{4}{4}\frac{3}{3} = \frac{1}{4}\frac{3}{3}$ fraction done by B, in (15 − 9 =) 6 hours.
$(\frac{1}{4}\frac{3}{3} \div 6) = (\frac{1}{4}\frac{3}{3} \times \frac{1}{6}) = \frac{1}{2}\frac{1}{5}\frac{3}{8}$, done by B in 1 hour.
Hence 258 ÷ 13 = $19\frac{1}{1}\frac{1}{3}$ hours. Ans.

2. ·0015 pint × 210 × 5 = 1·575 pints in a week.
1·575 × 44 = 69·3 ,, year.
69·3 pints = 8·6625 gallons, which at 2·95s.
= 25·554375s. = £1 5s. 6·6525d. Ans.

3. Bringing the men to their equivalent in women, we have 7m. = 10w., hence 1m. = $1\frac{3}{7}$w., and 16m. = (16 × $1\frac{3}{7}$ =) $22\frac{5}{7}$ women, Then $22\frac{5}{7}$ + 12 = $34\frac{5}{7}$, the equivalent in women of the 16 men and 12 women. Then by proportion, the men being eliminated,—

$$\frac{5\text{d.} \times 400 \times 10}{60 \times 34\frac{5}{7}} = 9\frac{1}{1}\frac{0}{8}\frac{8}{3} \text{ days. Ans.}$$

STANDARD VII.

1. £300 ÷ 480 = £·625 = 12s. 6d. prime cost per yard.
£300 + (£300 × 15 ÷ 100) = £345, total selling price.
£150 + ($\frac{1}{2}$ of £150) = £180 selling price of 240 yards.
£·625 × 100 + ($\frac{1}{10}$ of £62·5) = £68·75 ,, ,, 100 ,,
£·625 × 60 = £37·5 ,, ,, 60 ,,
Hence the above 400 yards sell for £286·25.
Then the remaining 80 yards must sell for (£345 − £286 5s.) £58 15s., that is at 14s. $8\frac{1}{4}$d. a yard. Ans.

2. £67 10s. − £65 = £2 10s. allowed as discount.
That is, on the true basis of discount, £65 (the P. W.) would make £2 10s. interest in 8 months, and consequently in 12 months would make £2 10s. × $1\frac{1}{2}$ = £3 15s. Hence £100 would make $\frac{1}{6}\frac{0}{5}$ or $\frac{2}{1}\frac{0}{3}$ of £3 15s., and $\frac{2}{1}\frac{0}{3}$ of $3\frac{3}{4} = \frac{2}{1}\frac{0}{3}$ of $\frac{1}{4}\frac{5}{0} = \frac{3}{2}\frac{0}{0}\frac{0}{0}$ = $5\frac{1}{3}$ per cent. Ans.

3. £400 requires £20 interest, hence £60 is paid off end of 1st year.
340 ,, £17 ,, £63 ,, off end of 2nd year.
277 ,, £13·85 ,, £66·15 ,, off end of 3rd year.
210·85 ,, £10·5425 ,, £69·4575 ,, off end of 4th year.
hence £210·85 − £69·4575 = £141 7 $10\frac{1}{2}$. Ans.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose names and address we will gladly give.

Magnetism and Electricity. By R. Wormell, D.Sc., M.A. Thomas Murby, 32, Bouverie Street, Fleet Street, E.C.

SECOND NOTICE.

Thus to compare :—

	WORMELL.	GUTHRIE.
Declination	20°.	17°.
Year of no Declination	1652	1657.
Maximum Declination	24°41′ *W.*	24°34′ *W.*
Year of Maximum Declination ...	1818.	1820.

The blunders that follow are not the fault of Dr. Wormell. They are all typographical errors, but we point them out in order to be of some service to the author in his production of the second edition, that will infallibly be required very speedily. (*a*). Title-page, last line, Fleet, Street, E.C., is not good. (*b*). Table of Contents, p. vi., line 6 from end, for 69 read 70. (*c*). P. 27, fig. 11. The letters of the diagram are bad and are deficient. The indescribable blur in the corner to the right should be R. Dr. Wormell has unfortunately in the description two R's for different lines (see lines 5 and 9), and the *n*, *s* referred to in line 13 of the letter-press is conspicuous by its absence in the diagram. (*d*) P. 37, line 5 from end, after the word figure, the number 5 ought to be inserted. (*e*) P. 54, line 4, 1.20 should be 120. (*f*) P. 100, line 8 from end under *d*, there is an omission. We are told to charge the jar as in ( ). (*g*) P. 103, line immediately above the figure, *a j* is referred to not visible in the diagram. (*h*) In Fig. 26, p. 128, would it not be better if the needles had their ends distinguished? (*i*) In Fig. 27, p. 129, there is no B, though reference is made to one in the text. (*k*) Why does Dr. Wormell have a little spelling of his own whenever he writes the name of Ruhmkorff? All the world holds to the orthography just given; but Dr. Wormell, with a persistency that seems as if it must be born of certainty, writes Rhumkorff. (*l*) P. 178, line 7 from end, for 'that' read 'the.' (*m*) P. 203, line 9 from end, for 'sparking' read 'striking.' (*n*) P. 208, Fig. 58, wants the *k k'* referred to in the line immediately above that otherwise admirable diagram. (*o*) P. 210, lines 14, 15, the strokes are turned in exactly the opposite direction to that each should take. (*p*) P. 211, line 1, for L read E. (*q*) P. 218, line 10, ought not R' and C' to be respectively R and C? (*r*) P. 227, line 10. For 'infringing' read 'impinging.' (*s*) P. 229, line 12 from end, we have suddenly introduced on this, the last page but two, as a sort of verbal Parthian arrow, the word 'dinymmetry' without a word of explanation.

We turn to the more agreeable, and, in this case, easy task of pointing out the good points in this notable little volume. (1). Dr. Wormell's definitions are very clear. Those of a current (p. 116), of a volt (p. 122), of a magnetic pole (p. 8), are good examples. He almost succeeds in making the idea of the dreaded 'potential' plain to beginners, and would wholly succeed with students who have given the subject of electricity a little attention. We are inclined to think that the best definition of 'potential' may be obtained by following up the analogy to temperature, and adopting the definition of the latter given by Professor Balfour, 'the condition of a body in regard to sensible heat,' we define potential as 'the condition of a body as to measurable electricity.'

On p. 36 Dr. Wormell manages to edge in a little piece of that sadly-neglected study, astronomy. It is to us always matter for regret that whilst every person pretending to education can tell you the common names of the ordinary flowers he or she sees by day, scarcely any can tell the name of one of the stars that are over and under them night and day.

Dr. Wormell, who is nothing, if not practical, gives a very interesting account of the compass in relation to modern ships. As many of these are of iron, and often carry iron, the reader will readily understand that many ingenious devices have to be planned for preventing the interference of the material of which the ship is composed, and often of its cargo, with the compass-needle. These are all narrated in very clear and interesting fashion in the eighth lecture on magnetism.

And, indeed, generally we may say that the great virtue of this book is clearness. Every explanation, with scarcely an exception, is admirably done, and the boy who cannot understand the principles of the two great cognate sciences, after reading Dr. Wormell's book, may reasonably despair of ever grasping them. As illustration of this clearness of explanation we may refer to the account of the condenser on pp. 96-98 or the proof, in connection with the tangent galvanometer, that the strength of the traversing current is proportional to the tangent of the angle through which the needle turns (p. 132, note), or on p. 169 the statement of Lenz's law.

An admirable analogy between the work done by a flow of water and that done by an electric current is worked out on pp. 192, 193, and would alone stamp the book as original.

The abbreviations D.P. for difference of potential, and E.M.F. for electro-motive force, and the capital mnemonic in the note on p. 194 show that Dr. Wormell is a teacher, and knows the value of time. Nor does our author despise occasional recapitulations (p. 130), and summings-up (p. 149.)

But, above all, we ought to praise the practical nature of this work. In these days when boys and men alike are cramming electricity and magnetism by book, and when even the books are far too full of theory and far too empty of descriptions of practical work, it is a delight to meet with a treatise wherein not only are simple experiments described in full in the body of the lectures, but every now and again a pause is made, and methods of making apparatus and conducting experiments are given in full. Even in describing the Holtz' machine, Dr. Wormell takes care to tell the student to place the discharging rods in contact before the machine has been set in motion, and to separate them after it is in motion—an important practical direction that we never remember to have seen in any other book on electricity.

The book is what we may call a progressive book. It leads the student on from the simple things to the more complex by well-graduated steps, and it ever keeps before him the few simple principles lying at the basis of magnetism and electricity, tracing back the most important and apparently difficult machines to one or more of these fundamental generalisations.

Finally, the book which brings us nearly up to the present hour's knowledge, though the photophone is omitted, ought to be of use especially to three classes of of people : (1) teachers of these two sciences, who might do well to model their lessons on those given here; (2) students who have to 'get up' these subjects for examination; (3) that increasing class of folk we meet in ordinary society, who, reading in their daily newspapers and in their monthly magazines of dynamo-machines, carbon points, Faure's accumulator, *id genus omne*, are naturally anxious to understand the general principles and construction of these machines that are intruding themselves so prominently and with such remarkable effect into our daily life. For these, no book we have read can compare with that we now lay down with the same statement as that with which we started :—If all the High School Series, of which the volume under review is one are as excellent as Dr. Wormell's little treatise, their standard will be very high.

Johnston's Sixpenny National Atlas. Edinburgh and London: W. and A. K. Johnston.

If scholars fail in learning geography it will not be from lack of maps, and those too of remarkable merit, together with cheapness. Among those who cater thus economically and excellently for the public, Messrs. Johnston occupy a deservedly leading position. We have before us specimens from their select list of maps suitable to all requirements,—from the school-boy who has but a penny to purchase a neat and excellent map of his county, or any other portion of the world he is studying,—to the nobleman whose library will be usefully adorned by the guinea map (of any division or country), on cloth and roller and varnished.

With such a plethora of wealth in the way of maps, selection becomes difficult; yet we would advise teachers and school managers to send for a list of Messrs. Johnston's maps, and see how well every kind of requirement can be well and cheaply supplied. In the series of school wall maps (4 ft. by 3 ft. 6 in.) an excellent map can be had mounted and varnished for 12s.!

In the little *Sixpenny Atlas* we have placed at the head of our list we have sixteen maps that are most of service to beginners, boldly and clearly printed with sufficient colour, but not a confusing profusion thereof, and wisely arranged in regard to the names being just enough, and not more than enough, for beginners. The land stands out clear in relief from the light blue tint of the water; large political divisions are marked by a bold red line; mountains by an equally bold dark blue line, and the main line of rivers marked without the needless addition of unnamed tributaries. This, we take it, is as it should be, in contradistinction to many maps ostensibly for beginners which are unwisely forced to do duty for everything—Botany and Zoology included. In the *Shilling Atlas* of the same series, we have twenty-four maps, and this collection done up in durable cloth.

The *Penny Maps* (14½ by 11½ inches), are issued in four series. Coloured ordinary maps with names; projections; outlines; and test maps, in which names only are omitted. Of these Penny Maps, the latest additions are an excellent set of county maps remarkable for clearness, and printed in pale red or pink tint. Of these, Surrey appears to be the most finished, as it contains,—in addition to the roads, railroads, and rivers,—the principal range of hills that extends lengthwise through the county, from Westerham to Reigate, Dorking, and Guildford, and terminates with the *Hog's Back* at Farnham, and also the isolated eminence of Leith Hill. Neither Middlesex nor Kent (the only others of the county series we have before us) contains marks for the hills. In regard to Middlesex, Highgate and Harrow ought thus to be marked, if not the elevated district that borders Hertfordshire, and culminates at Highwood, north of Mill Hill. Kent may, with more reason, complain of its hills being omitted. Its North Downs are a continuation of the Surrey heights, before mentioned, and extend through the county to Dover, and thence form most of the eastern elevations to Margate, where the chalk gives way to the clay that culminates in the Sheppy cliffs. In the map of Middlesex we have London marked by shaded lines that will soon have to be extended, and which in the present map stretch from Kensal Green on the west to Blackwall on the east; and from Holloway on the north to Camberwell on the south. We must now greatly extend our range, and notice Rolfe's truly magnificent map of *The Western Hemisphere* which Messrs. Johnston have just printed for themselves and Mr. Rolfe of Chicago. This noble map is printed in colours, (5 ft. by 4 ft.,) and has the coast marked by an additional tint. The most important territories, besides being tinted, are further indicated by delicate single or double oblique lines in contradistinction to territories merely coloured. For accuracy, beauty, and completeness, this map leaves nothing to be desired. The corners are filled up with maps of the North and South Polar Regions; the distribution of plants and animals, and the distribution of wind and rain over the Western Hemisphere. In the body of the map we have the great ocean currents plainly marked, and by which we can trace the Gulf Stream in all parts of its course. The descriptive letter-press at the foot of the map, a mere outline of geographical facts, we should like to see eliminated and the space occupied by charts or small explanatory maps of physical phenomena, such as the leading geological features of North and South America, or other matters illustrative of geographical science.

The above remarks will apply, *mutatis mutandis*, to *Rolfe's Eastern Hemisphere*, similar in size and other particulars to the Western. Together these maps form one of the finest illustrations of geographical science hitherto published, and can be used for smaller divisions with little to be desired in the way of detail. The four accompanying small maps illustrate the distribution of plants and animals, and wind and rain over the Eastern Hemisphere, and also the hemisphere of the greatest amount of land, and a corresponding one of the greatest amount of water.

Next we have, on the same magnificent scale, a *Map of Wales* (4 ft. 2 by 3 ft. 6 inches) and which is as remarkable for boldness as for beauty. The names of towns and villages are printed in large type, varying in three forms according to the importance of the place, *i.e.*, county towns being printed in full capitals, other towns in Roman, and villages in Italic type. The principal mountains have also a distinct type to themselves, of clear small capitals with the heights given in figures; the rivers have also their special type, and so have the bays and other openings. The railways and roads are also shown, and the main physical features given. In this we should like to see a few more names, such, for example, as the beautiful falls of the Tawe, and those of the Mynydd on its course towards the Neath. To the sons of old Cambria this map cannot fail to be welcome, and will doubtless find a place in every school in Wales, not only in regard to its excellence, but also on account of its cheapness; it being issued, varnished on cloth and roller, for 12s. This wall map is accompanied by a sixpenny hand-book descriptive of the Principality, which we should like to see expanded by larger type, and accompanied with wood-cut illustrations.

On the same large scale Messrs. Johnston have brought out a map of British North America, measuring 7 ft. by 4 ft. 2 inches, which will be particularly welcomed throughout Canada and other portions of the Dominion.

Africa, similarly treated in size and carefulness of finish, contains the most recent particulars down to the termination of the Zulu and Transvaal contests. The details of the south-western coast are much more fully treated than on any map we have seen. The comparatively unknown regions are also well filled up, and the dimensions given of the great central lakes. The Cape and other portions of South Africa of course are marked by a greater abundance of names, sufficient indeed for the educational requirements of all the schools of Cape Colony and Natal.

Every-day Life in our Public Schools. Edited by Charles Eyre Pascoe. London: Griffith and Farran.

This book is the work of nine writers, including the editor, who contributes an introductory historical chapter to each school, and the entire account of St. Paul's, Merchant Taylor's, and Christ's Hospital Schools. The book is readable to all, and must be particularly so to old scholars, or those now going through their course at the respective schools. The latter will be especially interested in the details of school life together with the multitude of allusions and slang terms peculiar to each school. To the general reader the opening chapters will be perhaps more interesting, and, in addition to the historical details, the influence of these great educational institutions on the national character cannot fail of arousing thoughtful

reflections. That they have accomplished great things and largely influenced the characters of our greatest men —more in 'the simple paths of manly truth' than in positive scholarship—is undeniable. That they might have done much more and avoided much that is to be deplored is also unquestionable. The great fact appears that the successes attained were very much owing to the accident of a good head-master, but the laxity of the State is also shown in evils being allowed to continue without the slightest attempt at correction. Another more serious consideration is the gradual diverting of these public schools from their original design of being for the benefit of the poor to that of being monopolized by the rich. In some cases—Winchester, for example—the founders gave permission for a few children of the upper classes to be admitted, but these were exceptional, and for the supposed benefit of the newly formed school, and were also in most cases not only limited in number but were to pay for their board. Wykeham only allowed ten of such boys to Winchester, and Mr. Pascoe tell us that 'of the latter class there are now over three hundred in the school—a very considerable and satisfactory (?) encroachment on the diminutive number appointed by Wykeham.' Speaking of Eton, Mr. Pascoe says, 'The summer half is the reign of idleness. All the muttered grumblings of dissatisfied tutors, all the terrors of "trials," "collections," and midsummer examinations, all the wisdom of masters' meetings cannot overthrow the rule of the enticing despot play.' There is something to be said in regard to the health and vigour thus developed, together with the influence of wholesome exercise on manliness, fairness, and other points of character. The tendency of our elementary school system has been to overtask the brain and treat physical exercise with comparative neglect. The consequences are a decidedly low tone of *play* among the children of our board and other schools. Our space, however, will not permit us to remark further on this topic, than to regret that so little is done to gratify our poorer scholars in this matter of play, so dear to every boy, and which is enjoyed so keenly by Etonians, that few leave the place 'without shedding a tear.'

Among the leading public schools, Mr. Pascoe speaks most highly of Winchester, which, he says, 'retains, almost more than any other great foundation school in England, the leading characteristics of its founder's design. Its scholars, it seems to us, are given more to work than to play; are more sober and sedate than the boys of other great schools we have visited; and, withal, are self-reliant, and manly, and modest, and, let us add, possess in a marked degree all the inherent qualities of young English gentlemen. They manage to hold their own in athletic exercises with their compeers of Eton, Rugby, and Harrow; and they more than hold their own with the scholars of these or any other great schools in the great public competitions.' Great praise this! To develope the mass of our youthful population into such characters is a great object. To combine Christian gentleness with simple self-reliance and the manly disdain of all that is mean or ungenerous requires more than intellectual training, more than sedulous theological instruction—which we should be far from wishing to undervalue—and which deficiency some of our great public schools appear to supply, notwithstanding their deficiences in some other respects.

Northumbria, The Captive Chief, and other Poems. By James Thomson. Alnwick: H. H. Blair.

This little book, to meet an honest judgment, must be viewed indulgently in connection with the station and circumstances of its author. He tells us that he is a working-man, and with the modesty of truthfulness counts himself as among the 'numerous versifiers and imitators of the heaven-born Art:' of such we may fairly call him an average specimen, seldom offending against either rhyme or rhythm, and keeping a respectable level of didactic and occasional versification: but neither the author himself, nor any of his better-judging friends, would ever go the length of claiming for him the exalted name and fame of that much-maligned and rarely-existent creature, a true poet. For this we require the fire and pathos of Burns,—feebly imitated in several portions of Mr. Thomson's booklet.; we demand gleams here and there of passion and pathos, but are scantly satisfied; where only alternate rhyming so usually occurs, our ear is continually disappointed; and although we shall endeavour to produce at all events one passage worthy of some praise, and are glad to find nearly none deserving of actual censure, still a righteous criticism must pronounce the author no genius, nor his verses on the whole above par.

An unnamed lady, who claims 'never to have written a letter in rhyme before,' but whose commendatory epistle is about the best thing in the book, wisely cautions her humble friend as to his poetic ambitions in this fashion:—

'The lyre the master-minstrel sweeps,
With bowèd heads men pause to hear,
And though its thrilling music clothe
A worthless theme, he need not fear;
The distant zenith holds his star,
Its rays to beauty turn each scar.

But when some nameless minstrel strikes
His trembling lyre with blush and stammer,
His measure, rhythm, and rhyme are scanned,
And woe betide his hapless grammar.
What wonder if he shrink and shiver,
And turn his back on fame for ever.

Accordingly, here and there we find a slip or two in grammar: as thus,

'Oswald,—no more glorious name
In dark Northumbrian history *gleam*.'

His accentuation in rhythm is often wrong; as thus,

'Oswald took their offering meet,
And laid it at Aidan's feet.'

And rhymes generally (as we have said) are conspicuous by their absence in the several ballads and songs, which rarely jingle more than two lines out of four. One, however, and only one, on Poor Doey, is a favourable exception; as thus for a specimen stanza,—but alas, for the slip in grammar!

'Poor Doey's dead and rests her head
Beneath a moss-grown tree;
We placed her there with tears and care—
I mean, my wife and *me*;
We neither spoke nor silence broke,
But in our hearts we said,
Our old friend's gone, and we're alone,
Our poor dog's lowly laid,' etc.

For a better sample, take part of 'The Trysting Tree:'—

'I ken wha's waiting in the glen
Beneath the trysting-tree;
And oh, I ken his heart beats fast,
And a' for love o' me.
My blessing on yon bonnie star—
The star o' hope to me;
It tells me that my Jamie waits
Beneath the trysting-tree,' etc.

But enough; our space is exhausted; and we have given our opinion honestly. The book is well enough for one with the scant educational and social advantages of its author, and will avail to gratify his friends, and perhaps himself: but to one who publishes 'Poems' under the famous and classical name of 'James Thomson' of the 'Seasons,' we can only accord the meed of 'faint praise.'

The Poems of Virgil, Translated into English Prose. By John Conington. Longmans.

The late Professor Conington, a man of rare genius, too early called away to the better world, has translated into vigorous English *verse* in the Marmion metre, all the

Æneid, and, if we are not mistaken, also the Bucolics and Georgics, albeit these may, perhaps, remain still in manuscript. The version now before us, one eminently serviceable to the practical teacher in an educational sense, is apparently the first rough copy in plain prose of what was afterwards matured into livelier and more readable poetry, and as exhibiting the interior of his officina, proves the industrious conscientiousness of the energetic workman; however, why it should have been published, or how it can prosper, in a Sosian sense, we cannot guess, more especially as it seems not to have been intended for publication by its moribund author. Very few people—except, indeed, schoolboys, for what they commonly call 'a crib'—are likely of set purpose to read through the Æneid in prose; albeit, when rhymed, Dryden helps us on with his ringing and stately versification, and Conington with his spirited short metres. Let us take as a favourite specimen, both of prose and verse, the celebrated panegyric on Marcellus, for which Augustus so generously rewarded his favourite laureate. Our space will permit only a short extract, but as a brick of the house it is a sort of testimony. The prose runs thus:

'Father Anchises began, tears gushing forth the while, "Alas, my son, ask not of the heavy grief which those of your blood must bear. Of him the Fates shall give but a glimpse to earth, nor suffer him to continue longer. Yes, powers of the sky! Rome's race would have been in your eyes too strong, had a boon like this been its own for ever. What groanings of the brave shall be wafted from Mars' proud field to Mars' mighty town! What a funeral, Father Tiber, shall thine eyes behold, as thou flowest past that new-built sepulchre! No child of the stock of Ilion shall raise his Latian ancestors to such heights of hope; never while time lasts shall the land of Romulus take such pride in any that she has reared. Woe for the piety, for the ancient faith, for the arm unconquered in battle! Never would foeman have met that armed presence unscathed, marched he on foot into the field, or tore with bloody spur the flank of his foaming steed. Child of a nation's sorrow! were there hope of thy breaking the tyranny of fate, thou shalt be Marcellus. Bring me handfuls of lilies, that I may strew the grave with their dazzling hues, and crown, if only with these gifts, my young descendant's shade, and perform the vain service of sorrow."'

Thus far Conington in prose—and very vigorous and picturesque it is; but his verse will have more attractions for the reader.

'The sire replies, while down his cheek
The tear-drops roll apace:
"Ah son! compel me not to speak
The sorrows of our race!
That youth the Fates but just display
To earth, nor let him longer stay:
With gifts like these for aye to hold
Rome's heart had e'en been overbold.
Ah! what a groan from Mars's plain
Shall o'er the city sound!
How wilt thou gaze on that long train,
Old Tiber, rolling to the main
Beside his new-made mound!
No youth of Ilium's seed inspires
With hope as fair his Latian sires:
Nor Rome shall dandle on her knee
A nursling so adorned as he.
O piety! O ancient faith!
O hand untamed in battle-scathe!
No foe had lived before his sword,
Stemmed he on foot the war's red tide,
Or with relentless rowel gored
His foaming charger's side.
Dear child of pity! shouldst thou burst
The dungeon-bars of Fate accurst,
Our own Marcellus thou!
Bring lilies here, in handfuls bring,
Their lustrous blooms I fain would fling:
Such honour to a grandson's shade
By grandsire hands may well be paid:
Yet, O! it 'vails not now."'

Surely, Virgil himself would prefer to be presented to the English mind in verse rather than in prose.

Gospel Types and Shadows of the Old Testament. By the Rev. William Odom. Nisbet and Co.

These Bible studies, each a likely skeleton for a Sunday sermon (they are fifty-two in number, suggesting a weekly exercitation), are the best shillingsworth a teacher or preacher can invest in, as full of religious knowledge and suggestiveness. From the notice paper of the first edition—this being the second—Mr. Odom's booklet has received hearty appreciation, and would appear to be a very useful synopsis of the Judaic Typology.

The Gospel of St. John. Intended for the use of Students preparing for Oxford and Cambridge Local and other examinations. By a Practical Teacher. London: T. Murby, Fleet Street.

This little manual has reached a new edition, and will be found a useful help to students of St. John's Gospel. It is explanatory rather than critical, and wisely leaves untouched several disputed points, including the verses of doubtful authenticity. As a help in rendering some of the old forms of expression agreeable to modern phraseology, the compiler has been successful and painstaking. Many lucid explanations are here given which would have to be hunted out of large and expensive commentaries. Such, for instance, as "Thou hast well said"—the expression Christ used to the woman of Samaria—meaning 'Thou hast truly or rightly said;' also 'which of you convinceth me of sin' is better rendered as the author says, 'convicteth me of any sin.' In some passages, however, we should prefer the original, without imputing to the author any bias. His honesty and fairness are evident throughout. In some passages we have the revised version referred to by way of explanation. Altogether the work cannot fail to be useful.

The British School Atlas of Ancient and Modern Geography. London and Edinburgh: Gall and Inglis.

This useful collection of thirty-four maps, imperial quarto, is accompanied by an excellent index of no less than 20,000 names, including the principal towns of the world, down to such places as Uxbridge, Dorking, Worthing, etc. The maps are printed in colours and remarkably full, but sufficiently clear withal to avoid confusion. Combining, as this atlas does, the essential features of ancient as well as extensive details of modern geography, it cannot fail to be useful to most students. In the map of England and Wales the hills, rivers, and towns are named in addition to the coast features, the railways being wisely omitted as being too confusing for this map. In the map of England, however, occupying the north-western portion of Central Europe, the principal railway lines are clearly marked, without militating against the general clearness of the mad.

Stories from English History. A Reading Book for Standard III. London: T. Nelson and Sons.

We congratulate the publishers of the famous Royal Series upon the issue of this introductory historical reading book. In all respects it is a really excellent work. No mere theorist could possibly have compiled it; evidences of the hand of the *practical* teacher appear on every page.

Simply and interestingly written, superbly illustrated, printed and bound in faultless style, and well within the grasp of Standard III. children, these 'Stories from English History' should command an extensive sale.

Query Column.

☞ **As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'**

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. 2ND YEAR P. T.—Simplify

$$\frac{\frac{3}{10}+\frac{1}{15}+\frac{3}{17}-\frac{1}{5}}{\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{8}} \text{ of } \frac{\frac{4}{1\frac{1}{7}}\times\frac{3}{1\frac{1}{2}}-\frac{4}{3\frac{1}{3}}\times\frac{2\frac{1}{2}}{1\frac{1}{2}}}{\frac{3}{10}\times\frac{1}{7}\times 3\frac{1}{2}+2\frac{1}{10}\times 1\frac{1}{6}\times\frac{1}{19}}$$

(*Brook Smith.*)

$$\frac{\frac{3}{10}+\frac{1}{15}+\frac{3}{17}-\frac{1}{5}}{\frac{3}{8}+\frac{1}{4}+\frac{1}{8}+\frac{1}{8}} \text{ of } \frac{\frac{4}{1\frac{1}{7}}\times\frac{3}{1\frac{1}{2}}-\frac{4}{3\frac{1}{3}}\times\frac{2\frac{1}{2}}{1\frac{1}{2}}}{\frac{3}{10}\times\frac{1}{7}\times 3\frac{1}{2}+2\frac{1}{10}\times 1\frac{1}{6}\times\frac{1}{19}}$$

$$= \frac{\frac{210+55+120-231}{1155}}{\frac{20+15+12+10}{60}} \text{ of } \frac{\frac{\cancel{4}}{\cancel{8}2}\times\frac{3}{\cancel{10}}-\frac{\cancel{4}^2}{\cancel{10}5}\times\frac{5}{\cancel{4}2}}{\frac{\cancel{3}}{\cancel{19}}\times\frac{\cancel{11}}{\cancel{7}}\times 2+\frac{\cancel{7}}{\cancel{55}}\times\frac{\cancel{11}}{5}\times 37\times\frac{\cancel{11}}{\cancel{8}}\times\frac{1}{19}}$$

$$= \frac{\frac{385-231}{1155}}{\frac{57}{60}} \text{ of } \frac{\frac{7}{2}\times\frac{27}{10}-\frac{\cancel{3}}{\cancel{8}}\times\frac{\cancel{3}}{\cancel{8}}}{\frac{3}{38}+\frac{37}{190}}$$

$$= \frac{\frac{\cancel{154}^2}{\cancel{11}\cancel{55}\cancel{19}}}{\frac{57}{\cancel{80}}} \text{ of } \frac{\frac{189}{20}-\frac{9}{4}}{\frac{15+37}{190}}$$

$$= \frac{8}{57} \text{ of } \frac{\frac{189-45}{20}}{\frac{52}{190}}$$

$$= \frac{8}{57} \text{ of } \frac{\cancel{144}\ 7\cancel{1}\ 18}{\cancel{19}\cancel{0}\ \cancel{5}\cancel{1}\ 13}$$

$$= \frac{8}{57} \text{ of } \frac{\cancel{342}\ 6}{13}$$

$$= \frac{48}{13}$$

$$= 3\tfrac{9}{13}. \text{ Ans.}$$

2. SUBSCRIBER.—If a certain number of workmen can do a piece of work in 25 days, in what time will $1\frac{1}{2}$ of that number do a piece of work twice as great, supposing two of the first set can do as much work in an hour as 3 of the second set can do in $1\frac{1}{2}$ hours, and that the second set work half as long a day as the first set? (*Barnard Smith.*)

$$\left.\begin{array}{l} 1\frac{1}{2} : 1 \\ 1 : 2 \\ 2 : 3 \\ 1 : 1\frac{1}{2} \\ 1 : 2 \end{array}\right\} :: 25 : \text{Time.}$$

$$= \frac{3\times\cancel{5}\times 3\times 3\times\cancel{5}\times\cancel{5}}{\cancel{8}\times\cancel{5}\times\cancel{5}}{}^{5} \text{ days.}$$

$$= 135 \text{ days. Ans.}$$

3. T. D.—The weights of equal quantities of lead and cork are as 11·324 : ·24; and 60 cubic inches of lead, with 54 of cork, weigh as much as 1,538¾ of fir; what number represents proportionately the weight of fir? (*Colenso.*)

If the weight of 60 cub. in. lead be represented by 11·324,
Then " " " of cork " ·24,
And " 54 " " " $\frac{\cdot 24\times 54}{60}$
$= \cdot 216;$

∴ The weight of 60 cub. in. of lead and 54 cub. in. of cork, or the weight of 1,538¾ cub. in. of fir, is represented by
$11\cdot 324 + \cdot 216$
$= 11\cdot 54;$

∴ The weight of 60 cub. in. of fir is represented by

$$\frac{11\cdot 54\times 60}{1538\frac{3}{4}}$$

$$= \frac{692\cdot 4\times 3}{4616}$$

$$= \frac{2077\cdot 2}{4616}$$

$$= \cdot 45. \text{ Ans.}$$

4. SCHOLARSHIP.—Find the cost of desk accommodation for a school of 168 children at 3s. 6d. per linear foot, each child requiring 21·75 inches; find also the average space in square feet per child if the room contains 8 equal groups of desks, three deep, each group occupying 152·25 square feet, with 8 gangways occupying 288 square feet, and a space of 10 feet is left clear in front of the desks. (*Scholarship*, 1880.)

Desk accommodation = 21·75 in. × 168

$$= \frac{87 \times 42}{12} \text{ ft.}$$

$$= \frac{609}{2} \text{ ft.}$$

Cost = $(\frac{609}{2} \times \frac{7}{2})$s.

$$= \frac{4263}{4} \text{s.}$$

= £53 5s. 9d. Ans.

Length of each desk = $\frac{609}{3}$ ft. ÷ 24

$$= \frac{203}{8} \text{ ft.}$$

Breadth occupied by desks = $152\frac{1}{4}$ sq. ft. ÷ $\frac{203}{8}$ ft.

$$= \left(\frac{609}{4} \times \frac{8}{203}\right) \text{ft.}$$

= 12 ft.

∴ Breadth of room = (12 + 10) ft. = 22 ft.

Width of a gangway = $\frac{228}{6}$ sq. ft. ÷ 12 ft.

= (36 ÷ 12) ft.

= 3 ft.

∴ Length of room = $\{(\frac{203}{8} + 3) \times 8\}$ ft.

$$= \frac{251}{2} \text{ ft.}$$

Area of room = $(\frac{251}{2} \times 22)$ sq. ft.

= 2761 sq. ft.

∴ Space per child = $\frac{2762}{168}$ sq. ft.

= 16·434...sq. ft. Ans.

5. IGNORANS.—A bankrupt has book-debts equal in amount to his liabilities, but on £6000 of them he can only recover 13s. 4d. in the pound, and the expenses of the bankruptcy are 5 per cent. on the book-debts; if he pay 13s. in the pound what is the amount of his liabilities? (*Barnard Smith.*)

The expenses of bankruptcy are 5 per cent. on the book-debts;

∴ Every pound is subject to a deduction of 1s. for expenses.

On £6000 only 13s. 4d. in the pound is realized, and therefore only 12s. 4d. in the pound is available for the creditors.

The creditors receive 13s. in the pound, and therefore (8d. × 6000) or £200 is required from the other debts to make up this deficiency.

The other debts are paid in full, and therefore there is a balance of 6s. on every pound of debt paid in full.

s. £ £

∴ 6 : 200 :: 1 : Amount of debts paid in full.

20

4000

£666 13s. 4d.

∴ Amount of liabilities = £6,666 13s. 4d. Ans.

6. CLARA.—A train 88 yards long overtook a person walking along the line at the rate of 4 miles an hour, and passed him completely in 10 seconds. It afterwards overtook another person, and passed him in 9 seconds. At what rate per hour was the second person walking?

Dist. walked by 1st person in 10 sec. = $\left(\frac{10}{880} \text{ of } 4 \times 1760 \text{ yds.}\right)$

$$= 1\tfrac{3}{10} \text{ yds.}$$

$$= 19\tfrac{3}{8} \text{ yds.}$$

Dist. travelled by train in 10 sec. = (88 + $19\frac{3}{8}$) yds.

$$= 107\tfrac{3}{8} \text{ yds.}$$

" " " " " 9 " = $(107\frac{3}{8} \times \frac{9}{10})$ yds.

$$= \frac{963}{10} \text{ yds.}$$

$$= 96\tfrac{3}{8} \text{ yds.}$$

∴ Dist. walked by 2nd person in 9 " = $(96\frac{3}{8} - 88)$ yds.

$$= 8\tfrac{3}{8} \text{ yds.}$$

∴ Rate per hour of 2nd person = $\left(8\frac{3}{8} \times \frac{60 \times 60}{9}\right)$ yds.

$$= \left(\frac{67}{8} \times \frac{4800}{1760}\right) \text{ miles.}$$

$$= 2 \text{ miles.} \quad \text{Ans.}$$

7. MAGISTER.—The discount due on a certain sum, due 9 months hence, is £20, and the interest on the same sum for the same time is £20 15s. Find the sum and the rate of interest.

Let S = Sum
R = Rate per cent.
I = Interest
D = Discount.

Then $I = S \times \frac{\frac{3}{4}R}{100}$

$D = S \times \frac{\frac{3}{4}R}{100 + \frac{3}{4}R}$

$I \times \frac{100}{\frac{3}{4}R} = S$

$D \times \frac{100 + \frac{3}{4}R}{\frac{3}{4}R} = S$

$\therefore I \times \frac{100}{\frac{3}{4}R} = D \times \frac{100 + \frac{3}{4}R}{\frac{3}{4}R}$

$I \times 100 = D \times (100 + \frac{3}{4}R)$

$I \times 100 - D \times 100 = D \times \frac{3}{4}R$

$(I - D) \times 100 = D \times \frac{3}{4}R$

$\therefore (£20\ 15s. - £20) \times 100 = £20 \times \frac{3}{4}R$

$\frac{3}{4} \times 100 = 20 \times \frac{3}{4}R$

$100 = 20R$

$\therefore R = 5.$

$S = I \times \frac{100}{\frac{3}{4}R} = £20\frac{3}{4} \times \frac{100}{15}$

$= £20\frac{3}{4} \times \frac{80}{3} = \frac{1660}{3}$ £ = £553 6s. 8d.

∴ Sum = £553 6s. 8d., and rate of interest = 5 per cent.

8. W. PREST.—A cistern has two supplying pipes, A and B, the former of which could fill it in 51 minutes; and it can be emptied by a tap, C, in 76 minutes. The cistern is empty, and A and B are turned on and run together for $8\frac{1}{2}$ minutes; A is then turned off and C is turned on; and 16 minutes afterwards B is shut and A re-opened; and when A has run with C for $13\frac{3}{5}$ minutes, C alone runs for 36 minutes more, and then the cistern is again empty. In what time could B alone fill the cistern?

Time A was open = $(8\frac{1}{2} + 13\frac{3}{5})$ min. = $22\frac{1}{10}$ min.

" B " " = $(8\frac{1}{2} + 16)$ min. = $24\frac{1}{2}$ min.

" C " " = $(16 + 13\frac{3}{5} + 36)$ min. = $65\frac{3}{5}$ min.

Part filled by A in 1 min. = $\frac{1}{51}$,

" " " $22\frac{1}{10}$ " = $\frac{1}{51} \times \frac{221}{10} = \frac{13}{30}$;

" emptied by C in 1 " = $\frac{1}{76}$,

" " " $65\frac{3}{5}$ " = $\frac{1}{76} \times \frac{328}{5} = \frac{82}{95}$;

∴ Part filled by B in $24\frac{1}{2}$ " = $\frac{82}{95} - \frac{13}{30}$

$$= \frac{492 - 247}{570}$$

$$= \frac{245}{570},$$

$$= \frac{49}{114},$$

∴ Part filled by B in 1 min. = $\frac{49}{114} \div 24\frac{1}{2}$

$$= \frac{49}{114} \times \frac{2}{49}$$

$$= \frac{1}{57};$$

∴ B could fill the cistern in 57 minutes. Ans.

9. ALPHA.—A wall is to be built to the height of 27 feet, and it is known that each successive 9 feet in height takes twice as long to build as the preceding 9 feet. In six days 12 men raise it to 9 feet; how many must be employed to finish it in four days more?

12 men can raise the first 9 ft. in 6 days,

" " second " " 12 "

" " third " " 24 "

∴ 12 men could complete it in 36 days;

∴ No. of men required to complete it in 4 days = $\frac{12 \times 36}{4}$

= 108. Ans.

Algebra.

1. EXCELSIOR.—A certain company of soldiers can be formed into a solid square; a battalion consisting of seven such equal companies can be formed into a hollow square, the men being four deep. The hollow square formed by the battalion is sixteen times as large as the solid square formed by one company. Find the number of men in the company. (*Todhunter.*)

Let x = No. of men in a side of the company,

Then x^2 = " " " the company;

And $7x^2$ = " " " " battalion.

As the hollow square formed by the battalion is 16 times as large as the solid square formed by one company,

∴ No. of men in a side of the battalion = 4 times No. of men in a side of a company,

$= 4x.$

No. of men in the battalion (hollow square)

$= 4x \times 4 \times 2 + \{(4x - 8) \times 4 \times 2\}$

$= 32x + 8(4x - 8)$

$= 32x + 32x - 64$

$= 64x - 64.$

$\therefore 7x^2 = 64x - 64$

$7x^2 - 64x = -64$

$x^2 - \frac{64x}{7} = -\frac{64}{7}$

$x^2 - \frac{64x}{7} + \left(\frac{32}{7}\right)^2 = \frac{1024}{49} - \frac{64}{7}$

$= \frac{1024 - 448}{49}$

$= \frac{576}{49}$

$x - \frac{32}{7} = \frac{24}{7}$

$x = \frac{24}{7} + \frac{32}{7}$

$\therefore x = 8.$

∴ No. of men in the company = 64. Ans.

2. OGLEY HAY.—Find the value of $\frac{x}{y}$ in the following equation :—

$$\frac{x^{2n} - ay^{2n}}{x^{2n} + ay^{2n}} = \frac{x^n - b(x-y)^n}{x^n + b(x-y)^n}$$

$$\frac{x^{2n} - ay^{2n}}{x^{2n} - ay^{2n}} = \frac{x^n - b(x-y)^n}{x^n + b(x-y)^n}$$

$$\frac{2x^{2n}}{2ay^{2n}} = \frac{2x^n}{2b(x-y)^n}$$

$$\frac{x^{2n}}{ay^{2n}} = \frac{x^n}{b(x-y)^n}$$

$$\frac{x^{2n}}{y^{2n}} = \frac{a}{b} \times \frac{x^n}{(x-y)^n}$$

$$\frac{x^2}{y^2} = \left(\frac{a}{b}\right)^{\frac{1}{n}} \times \frac{x}{x-y}$$

$$\frac{x^2}{y^2} \times \frac{x-y}{x} = \left(\frac{a}{b}\right)^{\frac{1}{n}}$$

$$\frac{x(x-y)}{y^2} = \left(\frac{a}{b}\right)^{\frac{1}{n}}$$

$$\frac{x^2 - xy}{y^2} = \left(\frac{a}{b}\right)^{\frac{1}{n}}$$

$$\frac{x^2}{y^2} - \frac{x}{y} = \left(\frac{a}{b}\right)^{\frac{1}{n}}$$

$$\frac{x^2}{y^2} - \frac{x}{y} + (\tfrac{1}{2})^2 = \left(\frac{a}{b}\right)^{\frac{1}{n}} + \tfrac{1}{4}$$

$$\frac{x}{y} - \tfrac{1}{2} = \pm\sqrt{\left(\frac{a}{b}\right)^{\frac{1}{n}} + \tfrac{1}{4}}$$

$$\therefore \frac{x}{y} = \tfrac{1}{2} \pm \sqrt{\left(\frac{a}{b}\right)^{\frac{1}{n}} + \tfrac{1}{4}}$$

3. W. R.—A mixed train of m passengers being supposed to realize n guineas to its proprietors as the gross proceeds of an excursion, assuming the proportions of the class fares to be p, q, r, and those of the corresponding receipts to be a, b, c, determine the number of the passengers and the fare for each class.

(*a*) Let x, y, z = No. of 1st, 2nd, and 3rd-class passengers, respectively;

Then, (1) $x + y + z = m$

(2) $x = y \times \frac{q}{p} \times \frac{a}{b}$

(3) $x = z \times \frac{r}{p} \times \frac{a}{c}$

(2) $x = \frac{aqy}{bp}$, $\therefore y = \frac{bpx}{aq}$;

(3) $x = \frac{arz}{cp}$, $\therefore z = \frac{cpx}{ar}$.

(1) $x + \frac{bpx}{aq} + \frac{cpx}{ar} = m$

$$\frac{(aqr + bpr + cpq)\,x}{aqr} = m$$

$$\therefore x = \frac{amqr}{aqr + bpr + cpq};$$

$$y = \frac{bpx}{aq}$$

$$= \frac{bmpr}{aqr + bpr + cpq};$$

$$z = \frac{cpx}{ar}$$

$$= \frac{cmpq}{aqr + bpqr + cpq.}$$

(*b*) Again, let x, y, z = Fares of 1st, 2nd, and 3rd classes, respectively;

Then, (1) $\frac{amqrx + bmtry + cmpqz}{aqr + bpr + cpq} = n$

(2) $x = y \times \frac{p}{q}$

(3) $x = z \times \frac{p}{r}$

(2) $x = \frac{py}{q}$, $\therefore y = \frac{qx}{p}$;

(3) $x = \frac{pz}{r}$, $\therefore z = \frac{rx}{p}$.

(1) $$\frac{amqrx + \left(bmpr \times \frac{qx}{p}\right) + \left(cmpq \times \frac{rx}{p}\right)}{aqr + bpr + cpq} = n$$

$$\frac{mqr\,(a + b + c)\,x}{aqr + bpr + cpq} = n$$

$$\therefore x = \frac{n\,(aqr + bpr + cpq)}{mqr\,(a + b + c)};$$

$$y = \frac{qx}{p}$$

$$= \frac{n\,(aqr + bpr + cpq)}{mpr\,(a + b + c)};$$

$$z = \frac{rx}{p}$$

$$= \frac{n\,(aqr + bpr + cpq)}{mpq\,(a + b + c)}$$

4. SEDGEMOOR.—Solve the following equation fully :—

$5(x-2)^2 + 7(x-3)^2 = (3x-7)(4x-19) + 42.$

$5(x-2)^2 + 7(x-3)^2 = (3x-7)(4x-19) + 42$

$5(x^2 - 4x + 4) + 7(x^2 - 6x + 9) = 12x^2 - 85x + 133 + 42$

$5x^2 - 20x + 20 + 7x^2 - 42x + 63 = 12x^2 - 85x + 175.$

$-62x + 83 = -85x + 175$

$85x - 62x = 175 - 83$

$23x = 92$

$\therefore x = 4.$

5. F. G. ROBINSON, Kirkham.—A goods train travels at the rate of 8 miles an hour on a railway; at the end of 12 hours it meets a passenger train travelling in the opposite direction, which arrives at the original starting station 16 hours after the goods train left. At what rate is the passenger train travelling? (*Scholarship*, 1871.)

Let x = rate of passenger train;

As it arrives 16 hrs. after the goods train left, it takes 4 hrs. to reach the station;

Then $4x$ = No. of miles travelled by passenger train after meeting goods train;

But this distance = (8 × 12) mls. = 96 mls.

$4x = 96$

$\therefore x = 24.$

∴ Passenger train is travelling at the rate of 24 miles an hour.

6. DEVONIAN.—Solve—$x^3 - 6x^2 + 11x = 0.$

$x^3 - 6x^2 + 11x = 0$

$x(x^2 - 6x + 11) = 0$

$x^2 - 6x + 11 = 0$

$x^2 - 6x = -11$

$x^2 - 6x + (3)^2 = 9 - 11$

$= -2$

$x - 3 = \pm\sqrt{-2}$

$\therefore x = 3 \pm \sqrt{-2}.$

$\therefore x = 0, 3 \pm \sqrt{-2}.$

7. (WYDDGRUG), CYMRU.—A man starts on a journey on foot, and walks three miles an hour. Two hours later his friend follows him on horseback and rides 7 miles an hour. Where will the latter overtake the former? (*Scholarship*, 1873.)

Let x = No. of hours after second starts when he overtakes the first;

Then $7x$ = distance travelled by second,

And $3(x+2)$ = " " " first.

$$\therefore 7x = 3(x+2)$$
$$7x = 3x+6$$
$$7x - 3x = 6$$
$$4x = 6$$
$$\therefore x = 1\tfrac{1}{2}.$$

$\therefore$ Second overtakes first ($1\frac{1}{2} \times 7$) miles, or $10\frac{1}{2}$ miles from starting-point.

General.

1. FAIRPLAY.—The expression 'breathing out oxygen' is lamentably inaccurate. Green parts of plants have a two-fold action in regard to the air. (1) They breathe. (2) They feed.

(1) *Respiration.*—In this process plants, as animals, take in oxygen that serves later on for that combustion of their tissues that always accompanies work. In this process also carbon dioxide is given out as the result of the combustion of the tissues.

(2) *Feeding.*—In this process plants take in carbon dioxide as food, keep its carbon, and give out its oxygen. But this is not a respiratory giving out of oxygen. We might as accurately say that when a man drinks champagne he 'breathes in' carbon dioxide. The error as to the 'breathing out oxygen" by plants has arisen from the fact that the feeding process in plants is far in excess of the breathing, so that the *total* effect, but never the respiratory effect of vegetables on the air, is the giving out of oxygen.

The stomata, despite the phrase of our friend Prof. Tanner, are regulators of transpiration rather than breathing apparatus. The whole general surface of the plant that is in contact with the air breathes. On page 84 of 'Vine's Translation of Prantl's Botany' it is written:—

'The stomata affect the transpiration of the plant inasmuch as they are the external openings of the intercellular spaces into which transpiration takes place from the neighbouring cells, and from which the watery vapour escapes into the external air.'

2. C. MILNE.—Your question was solved in our last issue. See No. 4 of the Arithmetical Queries.

3. T. H. B.—The solution of your query is given in the April No. Please state what parts of it you cannot understand, and we will endeavour to explain them more fully.

4. TURBATOR.—We advise you to accept the post of Assistant Junior Master in the Grammar School.

5. CONSTANT SUBSCRIBER.—You must remember that the statement in the ready reckoners of 2 inches 8 parts means $\frac{2}{12}$ ft. $+ \frac{8}{144}$ ft. $= \frac{32}{144}$ ft., and as in the case given it is cubic measure, $\frac{32}{144}$ cub. ft. $= 384$ cub. in. This agrees with the answer derived by the other method. By cross multiplication, 8 ft. $\times$ 2 in. $= 16$ in.; 16 in $\times$ 2 parts $= 32$ parts $= 2$ in. 8 parts.

6. MEMO.—Antoine's Practical French Verb Book (Hughes) 6d., or Chardenal.

7. W. J. P.—The two words are exactly the same in meaning, but some people prefer the 'x' to 'ct' because the former is more in accordance with the Latin word from which it is derived.

8. UNDERGRADUATE.—Hamblin Smith's.

9. DOUBTFUL.—Your extract is too long for analysis.

10. BONA FIDE.—You will find the solution of your query in the April Number.

11. LANCASTRIAN.—In the sentence—'The man saw a dog run across the lane,' *dog* is objective case by the verb *saw*, and *run* is in the infinitive mood, not indicative.

12. NOTTS.—No special Latin subject is selected for Scholarship Examination. Send for Syllabus of Matriculation Examination for French subject for June, 1883.

13. LILY.—Curtis's 'History,' 5s. 6d. (Simpkin & Co.), and Taylor's 'Notes of Lessons,' 1s. (Hughes).

14. EDITH.—Apply to Secretary, Civil Service Commissioners, Cannon Row, S.W.

15. J. B. MCLACHLAN.—1. The rule you give, though correct in most instances, does not hold good in all: ovis, nubes, dens, etc., though making the ablative singular in *e*, end in ium in the genitive plural. 2. The long *e* in Greek is pronounced as *æ* in English.

16. QUERIST.—Roscoe's 'Primer,' 1s. (Macmillan).

17. Q.—Apply to the Registrar of the University.

18. J. O'ROURKE.—1. and 2. Mansford's 'Mental Arithmetic,' 1s. 6d. (Hughes). 3. 'How to Compose,' 1s. (Hughes). 4. Savile's 'Guide to the Civil Service,' 3s. 6d. (Lockwood & Co.).

19. R. SMITH.—Amner's 'Guide to the Certificate and Scholarship Examinations,' 2s. 6d. (Moffatt & Paige).

20. WAMBA.—All the sides of two triangles touch the same circle; show that if their perimeters are equal, their areas are equal, and conversely. (Second Stage Mathematics, May, 1882.)

By Trigonometry,

Radius of the circle inscribed in a triangle $= \frac{S}{s}$ (where S = area of triangle, and $s = \frac{1}{2}$ sum of sides of triangle).

Now as it is the same circle, the area of one triangle divided by $\frac{1}{2}$ perimeter = area of the other triangle divide by $\frac{1}{2}$ perimeter;

but the perimeters are equal; (Hyp.)

$\therefore$ Areas are equal.

Conversely, if the areas are equal, $\frac{1}{2}$ perimeter of one triangle $= \frac{1}{2}$ perimeter of the other triangle;

$\therefore$ Perimeters are equal.

Mensuration.

1. PENTAGON.—Find the edge and longest diameter of a cubical tank which contains 134,217,728 cubic inches. (*Scholarship*, 1880.)

Length of edge of tank $= \sqrt[3]{134,217,728 \text{ cub. in}}$

134,217,728(512
125

$5^2 \times 300 = 750$ | 9217
$5 \times 1 \times 30 = 150$ |
$1^2 = 1$ |
7651 | 7651

$51^2 \times 300 = 780300$ | 1566728
$51 \times 2 \times 30 = 3060$ |
$2^2 = 4$ |
783364 | 1566728

$\therefore$ Length of edge of tank $= 512$ in. Ans.

If a = length of edge of tank,

Diameter of base $= \sqrt{2a^2}$

Longest diameter $= \sqrt{2a^2 + a^2}$

$= \sqrt{3a^2}$

$= \sqrt{3 \times 512^2}$

$= \sqrt{3 \times 262144}$

$= \sqrt{786432}$

78'64'32(886·8
64

168 | 1404
| 1344

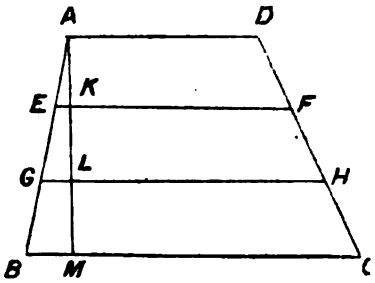
1766 | 12032
| 10596

17728 | 143000
| 141824

1776

$\therefore$ Longest diameter $= 886{\cdot}8\ldots$ in. Ans.

2. A. C. P.—The parallel sides of a trapezoid are respectively 8 ft. and 14 ft. Two straight lines are drawn across the figure parallel to these, so that the four are equidistant; find the lengths of the straight lines.



Draw AM perpendicular to the parallel sides.

$$\text{Area of ABCD} = \frac{AD+BC}{2} \times AM,$$

$$\text{,, ,, AEFD} = \frac{AD+EF}{2} \times AK,$$

$$\text{,, ,, EBCF} = \frac{EF+BC}{2} \times KM;$$

$$\therefore \left(\frac{AD+EF}{2} \times AK\right) + \left(\frac{EF+BC}{2} \times KM\right) = \frac{AD+BC}{2} \times AM$$

$$\left(\frac{8+EF}{2} \times \frac{AM}{3}\right) + \left(\frac{EF+14}{2} \times \frac{2AM}{3}\right) = \frac{8+14}{2} \times AM$$

$$\tfrac{1}{3}(8+EF) + \tfrac{2}{3}(EF+14) = 22$$

$$\tfrac{8}{3} + \tfrac{1}{3}EF + \tfrac{2}{3}EF + \tfrac{28}{3} = 22$$

$$EF + 12 = 22$$

$$\therefore \underline{EF = 10}.$$

Similarly,

$$\left(\frac{AD+GH}{2} \times AL\right) + \left(\frac{GH+BC}{2} \times LM\right) = \frac{AD+BC}{2} \times AM$$

$$\left(\frac{8+GH}{2} \times \frac{2AM}{3}\right) + \left(\frac{GH+14}{2} \times \frac{AM}{3}\right) = \frac{8+14}{2} \times AM$$

$$\tfrac{2}{3}(8+GH) + \tfrac{1}{3}(GH+14) = 22$$

$$\tfrac{16}{3} + \tfrac{2}{3}GH + \tfrac{1}{3}GH + \tfrac{14}{3} = 22$$

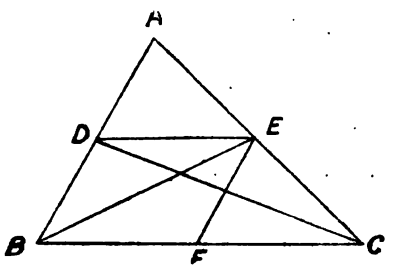
$$GH + 10 = 22$$

$$\therefore \underline{GH = 12}.$$

$\therefore$ Lengths of the straight lines = 10 ft. and 12 ft. Ans.

Geometry.

1. N. WATSON.—The straight line which bisects two sides of a triangle is parallel to the third side, and equal to one half of it.



Let D, E be the middle points of the sides AB, AC of the triangle ABC.

Then the straight line DE shall be parallel to BC, and equal to half of it.

Bisect BC in F, and join EF, BE, CD.

Proof— $\triangle BDE = \triangle ADE$, (I. 38.)

$\triangle CED = \triangle AED$, ,,

$\therefore \triangle BDE = \triangle CED$; (Ax. 1.)

Wherefore DE is parallel to BC. (I. 39.)

Similarly, it can be proved that EF is parallel to AB;

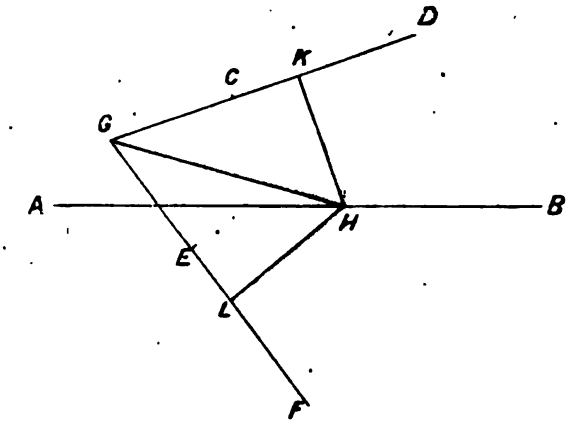
$\therefore$ DBFE is a parallelogram;

Wherefore DE = BF; (I. 34.)

but BF is half of BC;

Wherefore DE is equal to half BC. Q.E.D.

2. FOLKESTONIAN.—In a given straight line find a point such that the perpendiculars drawn from it to two given straight lines shall be equal.



Let AB, CD, EF be the three given straight lines.

Produce DC, FE, and let them meet in G.

Bisect the angle DGF by the straight line GH (I. 9), meeting AB in H.

Then H is the required point in AB.

From H draw HK, HL perpendicular to CD, EF, respectively. (I. 12.)

Proof.—In the triangles KGH, LGH,

$\angle KGH = \angle LGH$, (Con.)

$\angle HKG = \angle HLG$, (Ax. 11.)

and side GH is common to the two triangles, $\therefore$ side HK = side HL. (I. 26.) Q.E.F.

Note.—If the two given lines are parallel, bisect the *distance* between them.

3. INCOGNITO.—Construct a parallelogram equal to a pentagon, or any polygon.

Construction.—Divide the rectilineal figure into three, four, etc., triangles, as the case may be, and then the third, fourth, etc., triangles may be applied in the same way as the second (I. 45), until the required parallelogram is obtained.

Note.—Rectilineal figures are those contained by straight lines.

It does *not* mean four straight lines, but *any* number. Those contained by four straight lines are termed *quadrilaterals*.

Your simpler method of proving No. 3 Geometrical Query in our last issue is *entirely wrong*.

You say, $\angle BDF = \angle ADE$,

Add to each $\angle AED$,

$\therefore$ $\angle$s AED, ADE = $\angle$s ADE, BDF;

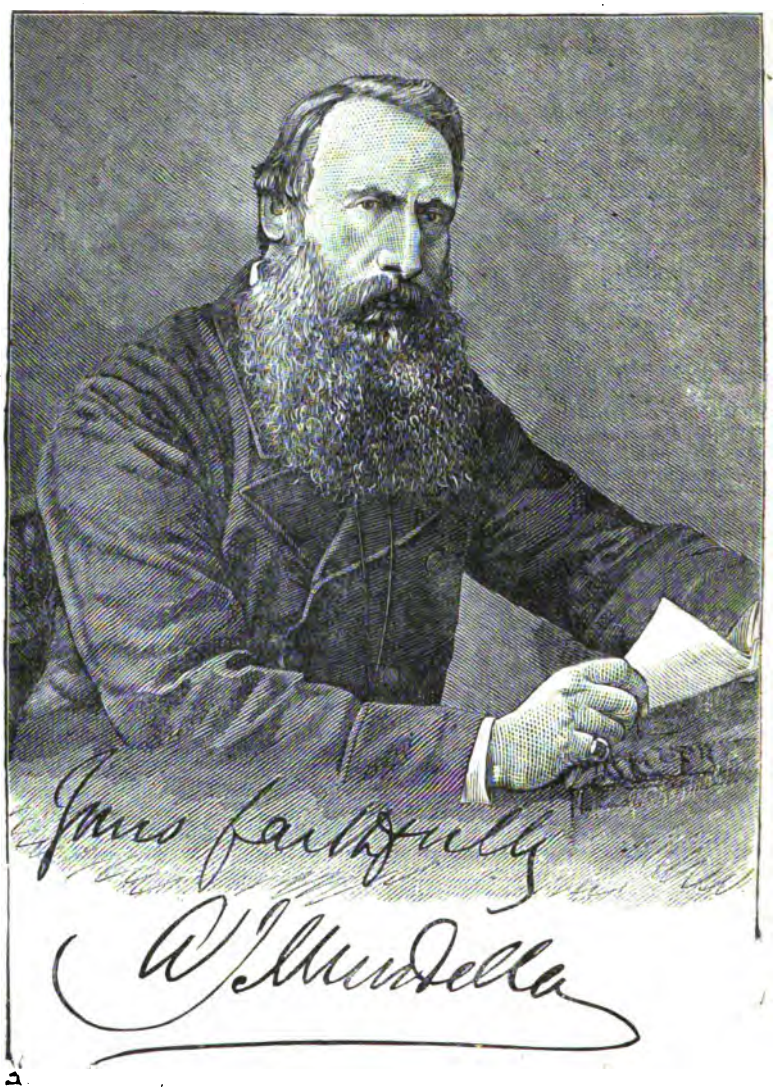
instead of $\angle$s AED, BDF.

The Church Schoolmasters' and Schoolmistresses' Benevolent Institution.

MR. MUNDELLA ON THRIFT.

THE twenty-fifth annual general meeting of the subscribers and friends of the Church Schoolmasters' and Schoolmistresses' Benevolent Institution was held (after a special service at St. Margaret's Church, Westminster) at the National Society's rooms, Broad Sanctuary, on the 20th of May. There was a crowded attendance, which was presided over by the Right Hon. A. J. Mundella, M.P. (Vice-President of the Committee of Council on Education). Mr. Mundella, in moving a resolution expressing approval of the society's work, said that while he had only recently become aware of the existence of the society, he found that it was doing such a good work that he should be glad to give it substantial aid by becoming a subscriber. There were few present, however familiar they might be with the

misfortunes which occasionally befell teachers—loss of life, loss of eyesight, their being stricken down sometimes suddenly by death, with orphans left behind—who could know more of the misfortunes than he had learned during his short experience at the Privy Council. His official position gave him an admirable insight into the position of teachers all over the kingdom. He had had to go through 500 or 600 applications for pensions and gratuities, so that he knew pretty well the claims teachers had upon the laity generally. It was very satisfactory that the friends of the society did so much for themselves. That was a point on which he wished more stress was laid. In the past they had had to do with many teachers in the National schools, because those schools had borne the burden and heat of the day. In the past the teachers of the National schools, especially in the rural districts, had to do a great amount of work for a very small remuneration. Upon investigating the cases of a number of old teachers, many of whom had served even fifty years as teachers, and were past three score and ten years, he was surprised to find that some were receiving a remuneration scarcely sufficient for bare subsistence. That was compensated for to some extent by their social status and by their knowledge that they were doing a good work; but certainly their remuneration was below that received by many an artisan. He was glad to know that education was not only more appreciated, but that the teachers' services were now better paid. He found that during the past ten years the teachers, both male and female, of the National Society, for instance, had benefited to an extent of nearly twenty per cent. increase upon the average earnings. There were to-day 18,130 certificated teachers employed by the National Society. The average earnings of schoolmasters in 1870 were £95 12s. 9d.; to-day they were £114 8s. 10d.; and schoolmistresses in 1870 earned an average of £57 16s. 5d.; and to-day £66 19s. 5d. No doubt even now there was room for considerable improvement in many cases. As to teachers as a body, he felt that they were a class which was doing more than any other to influence the next generation of English men and English women. They were the makers of the future England, and much depended upon them as to how it should be made. In common with other Englishmen, he was afraid they were deficient in one important characteristic, which he found so generally possessed by the profession in Scotland—viz., thrift. From the highest to the lowest he was afraid the English were an unthrifty people. There was no greater virtue they could cultivate than thrift; and in order that it might be properly cultivated they should set an example; and as they obtained an improved position he hoped that some portion of the increased remuneration would be set aside for the rainy day whenever it came. In going through the list of the many claimants upon the small fund at the disposal of the Education Department for pensions and gratuities, he had been struck with some strange things. First came the number of teachers among the applicants who had no means whatever to provide for the evil day. Then some of those who had the least to fall back upon were those who had lived in towns and had the highest salaries. The English teachers who had been the most thrifty were the teachers of the rural districts who had the smallest salaries. But there was one class of teachers who always had something to fall back upon, and those were the



Scotch teachers. What the Scotch teachers could do the English teachers could do. What he wished was that when teachers arrived at three score years, and could no longer discharge their duties satisfactorily to the children, the managers, and themselves, they should have a fair income to fall back upon. They ought to have it, and he trusted that they would. In the meantime he expressed his satisfaction that there was that Benevolent Institution in existence, which did a great and good work, and very often at the time of great affliction and necessity, when the teacher was broken down and exhausted, he was so aided that he was enabled to tide over his difficulties for a few months until he recovered his health and position. Mr. Mundella then quoted some statistics to show the progress of the institution from its commencement twenty-five years ago, and said that although the funds had greatly increased they were utterly inadequate to meet the many claims made upon the committee. The number of teachers increased in a greater ratio than the subscriptions. He should be glad if he could announce that some organized effort was made—not Government help, for they should help themselves—but he would like to see some organized system by an actuarial payment, so that all teachers might secure a certain sum in case of sickness, and when they reached the age when they ought to retire from the profession. He was not quite prepared to state how that could be done, but if any one had a definite idea on the subject he hoped they would communicate with others in the profession, and formulate some scheme which could be adopted for their benefit.

Gossip.

A FEW evenings ago we 'assisted' at a rather novel exhibition, held in the schoolroom adjoining the church, Upper Norwood, of which the Rev. S. A. Tipple is the pastor. It appears that last autumn an effort was made by Mr. J. Elliot Viney to induce the young people attending the church to turn to good account the long evenings of the coming winter. Practical help was promised to any boy or girl who chose to seek it. For this purpose one night a week was set apart, and little fingers that had essayed for the first time modelling in plaster, carving, carpentering, drawing, mapping, crocheting, etc., etc., were taught how to do their work skilfully. The exhibition, which was a pronounced success, was as varied as it was interesting, and it is a pleasure to add that every article was sold. The numerous pretty bouquets of wild-flowers, which adorned the tables, were sent on the following day to gladden the hearts of the inmates of a children's hospital. We congratulate Mr. Elliot Viney on his success, and trust his example will stimulate others to 'go and do likewise.'

***

Messrs. Griffith and Farran have a series of school reading-books in preparation which are intended to meet the requirements of the new Mundella Code. They are being edited by the compiler of 'Poetry for the Young,' and will be entitled 'Standard Authors Readers.'

***

We understand that the National Society has made a special grant of £500 to the proposed Training College for mistresses in East London.

***

A stained-glass window has been presented to St. Margaret's Church, Westminster, as a memorial to Sir Walter Raleigh, who is interred near the altar. The expense has been borne by American citizens, and Mr. J. R. Lowell, the celebrated poet, and American Minister in London, wrote the lines which are inscribed underneath :—

'The New World's sons, from England's breast we drew
Such milk as bids remember whence we came;
Proud of her past, wherefrom our present grew,
This window we inscribe with Raleigh's name.'

The window was unveiled at morning service on the 14th May.

***

Mr. Robert Browning attained his seventieth birthday on the 7th ult., and was presented by the seven Browning Societies of London, Oxford, Cambridge, Cornell, Bradford, Cheltenham, and Philadelphia, with a set of his own works, bound in olive morocco by Proudfoot, and enclosed in a handsome oak case carved with Browning emblems. The works were accompanied by a message that, as the works of a great modern poet could never be found in his own house (Mr. Browning always gives away all his own copies to friends), the societies begged his acceptance of a set of these works, and assured him that they would be found worthy his serious attention. The poet has since replied that he 'was never so honoured, so gratified, by any action of a similar nature that ever happened to him in the course of his life.'

***

The English Report, to be read at the forthcoming International Literary Congress at Rome, has been prepared, and will be presented to the Congress by the Hon. Howard Spensley and Dr. J. P. Steele, the delegates from this country.

***

Mr. J. S. Fletcher's new volume of poems will be published early this month by Mr. William Poole.

***

Mr. Alexander Gardner, well known for the good style in which his publications are sent forth, has recently issued a volume of selections from the writings of John Smith, who lived at Cambridge in the seventeenth century. The book, which has a capital introduction by Mr. Matthew Arnold, is entitled *The Natural Truth of Christianity*, and is really well worth reading

***

Ornithologists, who have not yet had an opportunity of seeing a perfect collection of humming-birds, would do well to visit that made by Mr. Gould, at the British Museum. It embraces several hundreds of specimens, and is undoubtedly the finest in existence. The arrangement is exceptionally good, and is not according to the usual formal method, the birds being displayed in a most natural and realistic manner.

***

Mr. Henry Irving's edition of 'Romeo and Juliet,' containing the full text of the acting version of the tragedy, is in its sixth thousand.

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Educational Publishers and the London School Board.

BY THE EDITOR.

WE doff our cap, make our best bow, and tender our sincerest thanks to Mrs. Westlake for the speech she made at a meeting of the London School Board on the 18th inst., anent the Requisition List. Understand us, please; we thank Mrs. Westlake, not for the insult she offered the publishers, nor for the aspersions which, in Miss Taylor's judgment, she cast on the great body of Metropolitan Board Teachers; neither do we feel particularly grateful to her (indeed, we rather pity her) for the ignorance she displayed; but we do thank her for the debate which her ill-starred speech provoked. In another part of our issue we give a full report of the proceedings of the last meeting of the Board, and we ask our readers to peruse that report most carefully.

In it allusion is constantly made by Mrs. Westlake, Mr. Morse, Dr. Gladstone, and Mr. Mark Wilks (we mention them in the order in which they spoke) to the interview which the sub-committee had with a deputation from the publishers. That deputation—appointed by the Board—consisted of representatives of the firms of Messrs. Longmans, Green, and Co., Messrs. Nelson and Sons, Messrs. Cassell, Petter, Galpin, and Co., and the writer of these lines. As no members of the Board, other than those on the sub-committee, seemed to be aware of the true nature of that interview, perhaps it will be advisable at the outset to give the publishers' version of it. To us who sat out the debate o Thursday last, it was painful to listen to th one-sided representations of it.

The Rev. T. Morse said—

'I attended a meeting of the sub-committee, at whic the representatives of the publishers were present, and believe that we convinced them that the course adopte by the Board was the right one.'

A statement more at variance with fact tha this was never made, unless it be that Mr. Mors interprets our concurrence with the Board i strongly denouncing the abuses of which the complained certain publishers had been guilty, a having 'convinced' us. The greatest, and indee the *only* point scored by the committee, wa when Mrs. Fenwick-Miller, in a happily-worde speech, conceived in a spirit entirely differen from the Wilkian-Westlake oratory, modestl urged that she thought her special love for an study of physiology rendered her a better judg of the books written on that subject than Boar teachers.

Equally erroneous is Mrs. Westlake's stat ment that 'the deputation that came up before u had nothing to say.'

The fact is, we answered all their objection so far as Mr. Mark Wilks would allow us. Th gentleman, fortunately or unfortunately, blessed with strong individuality, and has knack, when any one differs from him, of, to us the language of the Rev. J. Coxhead in a di cussion which preceded the one with which w are concerned, 'appealing to his own authority This means much; practically, that you a denied fair debate.

Dr. Gladstone's reply to Dr. Wainwright is a puzzle to us. The only explanation we can give of it is, that the Doctor must either have been deaf or attending to other matters and not have heard Mr. Longman's speech, or, having heard it, he must have forgotten its purport. Dr. Gladstone is reported to have said: 'When these publishers met us they never employed these arguments,' alluding to the remarks contained in the memorial. Mr. Longman, who spoke first on behalf of the publishers, *emphasized* 'these arguments,' viz., 'that the provisions set forth in the Education Code, and the interpretation of those provisions by Her Majesty's Inspectors of Schools, are sufficient to ensure the character of the books to be used'; indeed, they formed the basis not only of the speech he then made, but of the speeches he has made in the various committee and general meetings of the publishers. As an additional proof of this, it so happens that the very words of that part of the memorial are Mr. Longman's.

Mr. Wilks' opinion being but a reflex of Mrs. Westlake's, need not be dwelt upon. We pass over these two good people's uncalled-for insult to the publishing trade, to express our deep regret that the great body of teachers employed by the Board should be looked down upon by the Chairman of the School Management Committee as being 'unfit to be trusted'—the words we noted as they were spoken. With what exceptionally bad taste this attack comes from Mr. Mark Wilks, who himself, be it known to the world, is a trained elementary teacher, and whose son is, or recently was, an assistant in one of the Board's schools, we leave it to others to judge.

Having now given the publishers' view of their reception by the sub-Committee—*a view which is endorsed by every member of the deputation present at the interview*—we proceed to examine the reasons urged by the Board for the retention of their Requisition List.

And here we would quote the former part of the opening sentence of Mrs. Westlake's speech: 'It is well on this matter to speak out plainly.' If, in availing ourselves of this advice, she and her colleagues are hit rather hard, we promise them that the hitting shall, at least, have the merit of being fair.

The Board's reasons for retaining their Requisition List may be thus briefly summarized:—

1. That the Board, in the exercise of its functions as an important and responsible body, has a perfect right to buy and sell where it likes.

2. That teachers are not sufficiently 'cultured' (Mr. Wilks' own expression used to the deputation) to make the best selection of books.

3. That supposing the 'culture' of the teachers was on a par with that of Mr. Wilks and his colleagues (for that is really what it comes to), they are, as a body, 'unfit to be trusted,' owing to the readiness with which they accept bribes, etc., held out by the publishers.

4. That (we quote from Mrs. Westlake's speech) 'if we should open our Requisition List to the smaller publishers, the methods pursued by them would leave no chance for the more respectable firms, as only unfair means result in getting the books of other firms on to the Requisition List.'

5. That by the retention of the Requisition List, and the care exercised by the Committee, not only are the best books chosen, but no suitable ones are rejected.

We reply, under the *first* heading: This is a question of trade, which the recognised trade journals have answered for themselves. The *Publishers' Circular* (April, 1882) says:—

'Remembering that the School Board outlay is met by precepts to which the ratepayers, as represented by the vestries, have to yield instant obedience, it is difficult to see on what ground the Board can defend a monopoly which virtually excludes the London publishing firms from the supply of books for the Board schools. From the ratepayer's point of view the principle of an open supply at the discretion of the teachers and managers has the *primâ facie* recommendation that competition in the publishing trade is likely to result in the provision of the best works at the lowest prices, while on the broad ground of fair trading the Board is bound to show no favour.'

The *Bookseller*, March 1882, says:—

'There is an absolute unanimity of opinion that the Requisition List, as at present constituted, is a serious bar to the legitimate interests of the trade. It is a disturbing element in the economy of business, it checks enterprise, and is inimical to the cause of education itself.'

At last Thursday's meeting Mr. Spicer said:—

'The tendency of a requisition list so put together is to create a trade monopoly; around trade-monopoly corruption always clings.'

This question is now a public one, and as such it must be judged. In trying to substantiate the publishers' grievances, it will be impossible to avoid the mention of names; but as we are on friendly terms with every house in the trade, what we say cannot reasonably be attributed to private quarrel,—seeing there is none.

Mr. Wilks, in challenging criticism, contends that no monopoly has existed, nor has any favouritism been shown; that each book stands or falls on its own merits, and has fair-play. Then, if this be true, we should like to have explained to us the phenomenon of a young firm—it would be affectation to withhold the name now, Messrs. Isbister—young, at least, in so far as its school publishing department is concerned, with no long-established books to form the basis of an extensive business, commanding at one time an abnormal, and nearly always the largest share of the Board's patronage? This firm does *not* enjoy throughout the country the proud position which its account with the London Board would assign it—of issuing better books than any other house. If it did, its position on the List would prove an index to its

position in the country, and its accounts would be the largest there also.

The largest METROPOLITAN Elementary School Bookseller, who supplies the Voluntary Schools, where in nine cases out of ten the choice of books is left with the teacher, informs us that several firms do a larger trade with him than Messrs. Isbister do. This needs explanation; to put all the blame upon the poor teachers' shoulders is simply a miscarriage of justice. Will Mr. Wilks oblige us by referring to his file of the *Schoolmaster*? In the issue of that journal dated October 19th, 1878, he will find the following :—

'Some friends of the Rev. B. Waugh, formerly a member of the London School Board for the Greenwich division, have presented him with a cheque for 500 guineas, "as a mark of their appreciation of his work for neglected children, especially as a member of the first and second School Board for London, and as an expression of their sympathy with him in his present enforced retirement from public life." Mr. Waugh has been lately engaged in connection with the editing of the *Sunday Magazine* and in *producing school books for the house of Daldy, Isbister and Co.*'

Now, we hold we do not overstep the bounds of fair criticism when we inquire, not who these friends were, but whether or not Mr. Waugh was engaged in producing school books for the house of Messrs. Daldy, Isbister, and Co., during the time he was Chairman of the Books Committee, whose duty it was to select books for use in the Board schools?

If he were *not* engaged in this work during his connection with the Board—and we do not say that he was—does it not strike our readers as being a singular coincidence that he, and subsequently the Rev. J. A. Picton, at one time also an active member of the *Book Committee* of the Board, should join Messrs. Isbister and Co., whose transactions with the Board are so large? It is matter of common notoriety that this firm has for years engaged one or more London Board inspectors to prepare elementary school-publications. If these inspectors had been engaged in the production of only two or three books, no voice would have been raised; it is the long-continued connection which is objected to.

And for Mr. Mark Wilks, who is one of Mr. Picton's friends, to affect ignorance of these facts, and to ask us to believe in that ignorance, is to tax our credulity to a point that becomes ridiculously childish.

Mrs. Westlake referred indignantly in both her speech to the deputation and the one reported in our columns, to the practice—a perfectly fair and legitimate one—adopted by all respectable firms (though she and Dr. Gladstone denied it) of sending travellers round to schools with samples of new publications. Perhaps her wrath will wax still stronger when she hears that to-day Messrs. Isbister not only employ (to borrow a word from her own vocabulary) 'touters,' but that one of these 'touters' is actually the father of one of the members of the School Management Committee. Of the character of that member we cannot speak too highly; we simply state the fact to show Mrs. Westlake's ignorance.

We pass on to the second reason: that teachers are not fit intellectually to make the best selection of books.

Miss Taylor's answer is complete. She said :—

'We hear a great deal about experts in education. Is it not open to the plainest common-sense that three or four members of the sub-committee are not so well qualified to judge of the best books in teaching as the vast mass of head-teachers employed by us? If the head-teachers are not fit to judge upon these books, I challenge the chairman of the School-Management Committee to dismiss them from their places and to elect others in their stead.'

To assert that a few amateur educationists, for the majority of the Books Committee are nothing more (as we think this article will prove), are better, or as well fitted, as men and women who have devoted their lives to education in its most practical form, is not worth the trouble of a denial. But apart from their special training, consider for a moment the incentives the head-teachers have for choosing the very best tools; their professional status, their advancement in life, nay, their very means of livelihood, depend largely upon a wise selection being made. And yet we are blandly told by the Wilkian-Westlake compact, that teachers as a body are unfit to be trusted; in other words, that they will forego all that is dear in life for a paltry champagne supper, or a stall at a theatre. Evidently they have overshot the mark for once. Granted, for the sake of argument, that a teacher makes a bad selection of books; it needs no wiseacre to see that that would speedily work its own cure.

The *third* charge has been already met in the foregoing remarks. Speaking as an old teacher, and in the name of teachers, we characterise the remarks made by Mrs. Westlake as a gross libel on the honour of the great body of teachers. That cases of bribery here and there may occur we do not deny; but these are only the exceptions which prove the rule.

We ask careful attention to the *fourth* reason, the former part of which reads thus :

'if we should open our Requisition List to the smaller publishers, the methods pursued by them would leave no chance for the more respectable firms.'

The most complete reply possible to this statement is, that 'the more respectable firms' reject Mrs. Westlake's maternal solicitude about their interests, and have signed the memorial. These names have not appeared in print before, and a perusal of them will show the unanimity that prevails in the trade. The odd exception or two only strengthens our position. Nearly every house which issues *elementary school publications* is represented, and we challenge Mrs. Westlake to name, in common justice to the firms who signed the memorial, the publishers,

small or great, who have been guilty of reprehensible practices.

There is no misgiving about her statements; she speaks with the authority of knowledge. Listen:—'One firm sent out theatre-tickets to teachers; another firm invited teachers to champagne suppers. Another case was far more serious—that of a publishing firm lending money to teachers, and another by backing their bills.'

Surely no woman would be so rash and indiscreet as to make these serious charges without good foundation. But what has Mr. Wilks, who seems to have changed his mind since the deputation waited on him, to say on this question?

'With reference to the question put as to why the name of the publisher who had given the champagne supper had not been removed from the List, seeing that the fact was known to the Committee three months, the explanation is that it has been difficult to verify the statement. *I have heard of it in the way of trade.*'

(The italics are ours.) Were there ever weaker arguments put forth in defence of the conduct of a public body than this? If Mr. Wilks' statement is true, what shall we say of Mrs. Westlake's conduct? This matter cannot be allowed to rest here. In the name of the publishers of London, we demand that these gross charges be at once substantiated or withdrawn.

In reply to Dr. Gladstone, we would respectfully inform him that it is a most *unusual* thing for an educational house to indulge in the festivities of which he speaks; and we put it to him, which firms are the most likely to have bribed—those who signed the memorial, or those who did not?

But what does Mrs. Westlake mean in the closing part of the sentence we just quoted as the fourth reason?

'only unfair means result in getting the books of other firms on the Requisition List.'

If such a thing is POSSIBLE, that unfair means *do* result in getting books on the Requisition List, there is an end of the whole matter, and the sooner the Requisition List is swept away the better.

Of the *fifth*, and last reason, we shall have no difficulty in disposing. Without even leaving the meeting in question, we propose to show that Mr. Wilks cuts the ground from under his own feet. The Rev. G. M. Murphy said at the meeting:

'while in a school in Finsbury some time ago, I found a book which I was told had been written by one of Her Majesty's Inspectors for that division. A more UNSUITABLE book for our schools could not be found.'

Here we actually have a case where a book is considered by a prominent member of the Board so unsuitable for school use, that he publicly calls attention to it. In reply to Dr. Wainwright, Mr. Wilks said:

'That is quite a matter of opinion as to whether the book is unsuitable or not.'

He virtually, however, acknowledges that the book is not a fit one, else why should he subsequently announce 'that the book is to be removed from the List by order of the Committee?'

That the best books are not always selected is, therefore, from this case, brought up not by an outsider, but by one of the members, quite clear. The evidence that books which fulfil the requirements of the Code in every respect are rejected, is overwhelming. Let us take two recent instances, where the firms mentioned shall be of such high standing that every work bearing their imprint carries a recommendation with it. The Board has declined Messrs. Nelsons' Geographical Readers, and Messrs. W. and A. K. Johnston's series of Schoolroom Maps. Now, we challenge the School Management Committee to prove that these publications are not 'suitable.' Of their excellence and exact adaptability to elementary school work there cannot be two opinions among competent critics. They have met with the heartiest approval of inspectors all over the country, which assertion brings us to the following most important part of Dr. Gladstone's speech:—

'Dr. Wainwright says that we have not answered the remarks of the Publishers' letter in our proposed reply. When these Publishers met us they never employed these arguments.'

To this assertion we have replied. But now comes a revelation of a lack of knowledge of the real facts of the case that few people would have credited the Chairman of the Book Committee of the London School Board with:—

'I believe that Her Majesty's Inspectors are entirely forbidden to approve any particular book, and are required to approve only the particular method of teaching.'

If the Doctor will refer to his copy of the New Code he will find on p. 115 the 'Standards of Examinations' set forth. The first footnote on the first subject reads thus:—

'Reading after Standard I will be held to include intelligence and fluency increasing with each Standard. It will be tested in the ordinary class-books, *if approved by the Inspector;* but these books must be of reasonable length and difficulty, and unmarked.'

So that, as every tyro in teaching knows, the reading-books he uses *must be approved by Her Majesty's Inspector.* But what Her Majesty's Inspectors are expressly *forbidden* to do is to interfere with the *methods* of teaching. It is an open secret that not long ago an inspector who meddled with the 'methods of teaching' in a certain school was taken to task by the Department. It is not an inspector's duty to prescribe methods; his office is, to test results.

But we desire to draw special attention to Mrs. Westlake's statement. Personally we would let the whole question hinge on this lady's testimony, it is so conclusive. Hear her:—

'I share sympathy with my colleague, Mr. Morse. He and I were asked to look over the reading-books sent to the Board, and we took great pains to examine them. We devoted months to the reading of these books, and I must say that I rose from their perusal a wiser and a sadder woman.'

She then proceeds to characterize bad books, books that had evidently been rejected :—

'There was in many cases no end and no beginning—subjects dealing with a wide range without any connecting link, and the result is that children get odds and ends of knowledge without any system of connection.'

Precisely so; but will Mrs. Westlake go a step further and name the reading-books which she and her colleague approved and placed on the List that do not answer to the above description? Her remarks apply to every set of readers issued, if we except the odd consecutive series here and there, which, relatively speaking, have no sale.

It may be asked, what do publishers want? We believe Mr. Spicer exactly represented the feelings of the trade when he said: 'I would not take all the books, but all those that come up to the full standard.' What publishers seek is fair play all round, and no favour; that the Board do not create a code within a code, and reject books that fulfil the requirements of the Education Department, and that any inspector in the country would approve; that when a teacher requisitions a work on the List and does not overstep the average limit, it shall be supplied; that the Board's Inspectors shall be prohibited from writing *school-publications*, or if they write them it must be on the distinct understanding that they cannot be adopted by the Board.

In conclusion, we contend that we have shown that the Requisition List tends to create a monopoly inimical alike to trade enterprise and to the interests of education; that its retention neither secures the adoption of the best books, nor the rejection of the worst; that teachers are, as a body, as fit, intellectually and morally, to be trusted as any class represented by the members of the School Management Committee, and that their List is a needless restriction upon the practical educative work of the Board.

The School Board for London and the London Publishers.

18th May, 1882.

The School Management Committee presented a Report as follows:—

24. On the 30th of March the Board referred to the School Management Committee, for consideration and report, the following letter from forty-three publishers or firms of publishers:—

'Pilgrim Street, Ludgate Hill, London, E.C.,
March 25th, 1882.

'TO THE CHAIRMAN AND MEMBERS OF THE LONDON SCHOOL BOARD.

'SIR, LADIES AND GENTLEMEN,—

'For a long time past there has been a feeling of dissatisfaction at the effect produced by the operation of the Requisition List of the London School Board upon the publishing trade. The result of this list has been of a character to limit the use of books to a selected number, instead of throwing the choice open to all which fulfil the requirements of the Code.

'We should esteem it a favour if you would take into consideration the question whether it is necessary to the efficient carrying out of the work of your Board that this Requisition List should be retained.

'We would venture to suggest that the provisions set forth in the Education Code and the interpretations of those provisions by Her Majesty's Inspectors of Schools are sufficient to insure the character of the books to be used, and that teachers should be allowed the right of selection within the limits of the aforesaid provisions.

'We believe that the greater freedom advocated by us would be found beneficial to the true interests of education.'

Longmans, Green and Co.
T. Nelson and Sons.
Cassell, Petter, Galpin and Co.
Griffith and Farran.
W. and A. K. Johnston.
W. Swan Sonnenschein and Co.
W. and R. Chambers.
John Heywood.
Allman and Son.
J. Blackwood and Co.
Thomas Laurie.
John Marshall and Son.
Moffatt and Paige.
W. Stewart and Co.
Oliver and Boyd.
Charles Akrill.
J. H. Houghton.
G. Philip and Son.
Thomas Murby.
R. J. Derfel.
Sampson Low and Co.
Bean and Son.
Midland Educational Co. (Limited).
North Western Educational Co. (Limited).
North of England School Fur. Co. (Limited).
Charles Griffin and Co.
W. H. Allen and Co.
W. Binns.
Educational Supply Association.
A. Brown and Son.
J. B. Ledsham.
Gall and Inglis.
Strahan and Co.
Kegan Paul, Trench and Co.
Cameron and Ferguson.
G. Routledge and Sons.
Ward, Lock and Co.
Houlston and Sons.
Hodder and Stoughton.
W. Kent and Son.
Bemrose and Sons.
Crosby Lockwood and Co.
Joseph Hughes.

The School Management Committee referred this letter to the Store Sub-Committee for consideration; and that Sub-Committee have had an interview with the representatives of three of the firms who signed the letter. The School Management Committee, having considered their Sub-Committee's report, recommend that a reply be forwarded to the Secretary of the Publishers, stating that after an interview with the representatives of some of the firms, the Board have fully considered the matter, and see no reason for altering their present practice.

MR. MARK WILKS (Chairman of the School Management Committee) moved:—

24. 'That, in accordance with the recommendation of the report, a letter be forwarded to the Secretary of the forty-three publishers, or firms of publishers, in reply to their letter respecting the Board's Requisition List, and the limit of selection allowed teachers.'

An amendment thereon was moved by Mr. Sydney Buxton, and seconded by Mr. Richardson:—'That the proposed resolution be referred back to the School Management Committee with instructions to bring up a draft reply for the consideration of the Board.'

Mr. BUXTON said: I believe our requisition list is quite satisfactory, and I do not think it would be well to send a letter like this; but rather, having considered the matter, that we should send a civil reply explaining our position, and stating that we do not propose to take any further action. I believe

there was one drawn originally to that effect before this proposed reply was agreed upon. I know there has been a considerable amount of dissatisfaction about the way in which our requisition list has been carried out.

Mr. G. B. RICHARDSON: I want to know what Mr. Sydney Buxton means by 'our position'—I do not know what it means. To me it seems to be wrong that we should absolutely exclude any books from the list which publishers issue. Why should we shut up our list against any of them?

The Rev. THOMAS MORSE: I attended a meeting of the sub-committee at which the representatives of the publishers were present, and the matter was very fully discussed there, and I believe that we convinced them that the course adopted by the Board was the right one. We told them the special reasons which existed, but they were not reasons which could be discussed openly at the Board. I think the Board might well be satisfied with the conclusion that was then come to. If Mr. Buxton had been a member of our Committee I think he would have been satisfied with the letter which it is proposed to address, and that it is quite unnecessary to make any change.

Mrs. WESTLAKE: It is well, on this matter, to speak out plainly, and to say that we consider our requisition list ought not to be open to all publishers. You are aware of what there has been going on. You are probably aware that there has been a multitude of little school books issued purporting to answer the requirements of the Code, which supply but a small modicum of knowledge. These little books are issued in shoals by the various publishers, especially by those firms of small and struggling publishers who wish to make a name and a fortune. The large firms, as a rule, do not issue many of these books, which are issued by thousands, and offered upon pressure to the School Management Committee. What are the means adopted by these firms? An enormous amount of touting must be done. Those members of the Board who go to the schools and come in contact with the teachers discover how these touters call at the schools and leave books there. For that reason, a rule had to be made to keep the doors closed against these touters, but this was of but small importance compared with other practices. One firm sent out theatre tickets to teachers; another firm invited teachers to champagne suppers. Another case was far more serious—that of a publishing firm lending money to teachers, and another by backing their bills. I need not say that this is a very insidious way of pushing business, and it is not surprising that some people cannot resist the temptation to use the books and the apparatus published by these firms. We must keep our teachers free from such temptation. I must mention the fact that the great firms do not practise such means. They send their wares into the open market, and try to sell them by legitimate methods; but if we should open our requisition list to the smaller publishers, the methods pursued by them would leave no chance for the more respectable firms, as only unfair means result in getting the books of other firms on to the requisition list; and it certainly follows that the books of these unfair dealers are not likely to be the best. In fact, the Stores Committee almost came to the conclusion that, instead of opening its list to a greater number of books, it ought, on the contrary, to further restrict that list, and to settle itself what books shall be used in the schools. At the present time the requisition list is very broad, and really does allow very great choice, to meet a teacher's notion of the method of instruction most suitable in their respective cases. It is a fact, that publishers look upon the London School Board as a great advertising medium. The books we adopt are chosen by copy of example by many of the Provincial School Boards, and on that account we should be very careful as to what we admit. I share sympathy with my colleague, Mr. Morse. He and I were asked to look over the reading books sent to the Board, and we took great pains to examine them. We devoted months to the reading of these books, and I must say that I rose from their perusal a wiser and a sadder woman. In many cases, the subjects had no connection the one with the other; each seemed to hang on its own hook as it were. There was, in many cases, no end and no beginning—subjects dealing with a wide range without any connecting link, and the result is that children get odds and ends of knowledge without any system of connection. I think we are bound to say that our books should be systematic, and capable of meeting the wants of children to the full extent of their several standards. The deputation that came up before us had nothing to say in answer to our objections. The large firms seemed to be perfectly satisfied with our present plan.

Dr. WAINWRIGHT, quoting the terms of the proposed letter, said: This is not an argument, but dictation; this is the language of the proposed document; the Committee omit to say what is advanced on the other side.

Miss TAYLOR here rose and complained of some members holding conversation, and stated that the Chairman had insisted upon complete silence being maintained while the terms of the Report were being advanced.

The CHAIRMAN: That is very strong language, Miss Taylor.

Miss TAYLOR: It is, Sir.

Miss TAYLOR then rose and said: I should have been disposed to accede to the recommendation of the School Management Committee but for the reasons given; and, in the name of all the teachers of London, I do protest against the aspersions cast upon them. We have heard that two or three members of the Sub-committee, or the whole Committee, who dispense the patronage of this Board, can do so with credit, while teachers are supposed to be guilty of actions which are not to be criticised. I challenge the Board to say or to name, any teacher under this Board who has been guilty of the practices referred to. I make this challenge in their name, because it is not in their power to answer the accusation at this Board. Head-teachers under this Board include many honourable men and teetotallers, who are not amenable to the temptation of a champagne supper, and they include women as well as men, women head-teachers as well as male head-teachers, who also have the selection of books from the requisition list. I challenge any one to say that any lady teachers accepted any champagne suppers. I deny that they have done so. I think that if champagne suppers were in question, two or three members of the Sub-committee would be more easily bribed than all the teachers of London. Then we are told that one or two publishers lent money to the head-teachers—we heard that a fortnight ago. On that occasion I moved that our assistants should be paid their salaries in a direct manner from the Board itself, instead of through the head-teachers. The CHAIRMAN of the School Management Committee, then boiled over in righteous indignation at its being supposed that more than one teacher was in the habit of borrowing money. He sits quietly enough now when his own colleagues are in question, and when it is said that the teachers borrow money in such numbers as to degrade their calling. I would not sit quietly in his position while hearing that such things were done by the teachers of the Board. On the other hand the question arises as to the variety of our teaching from the books used by us. I do not, and many of us do not, approve of the degree of centralization which has been carried on under this Board. If the servants of all the public bodies were to be governed in this way, where would be the room for originality and variety of talent? What suits one teacher will not suit another. A man or a woman of special genius ought to have some latitude given for his or her method of teaching. We hear a great deal about experts in education. Is it not open to the plainest common-sense that three or four members of the Sub-committee are not so well qualified to judge of the best books to use in teaching as the vast mass of head-teachers employed by us? If the head teachers are not fit to judge upon these books, I challenge the Chairman of the School Management Committee to dismiss them from their places, and to elect others in their stead. If our head-teachers are not honest enough to be trusted with the smallest amount of patronage in selecting books for their own schools, I trust now that the teachers will judge as it deserves the aspersion that has been cast upon them and the silence of the Chairman of the School Management Committee in this respect.

The Rev. J. R. DIGGLE: We have heard to-day a defence of the requisition list. I want to ask two very plain questions. The first is this: It was mentioned at the Board a short time ago that one of the publishers lent money to a master in a school who requisitioned for that publisher's books. I want to know that publisher's name, and whether it has been removed from the list. The second is this,—it has been within the knowledge of the Stores Committee that a certain publisher gave a champagne supper to a number of our teachers, and it has been insinuated that this was done with the object of securing patronage. The general inference is that those teachers should look favourably upon these publisher's books when they came to the requisitions. I ask whether that publisher's books are on the list to-day, and whether his name has been removed from the list. Grave suspicion rests on the Sub-committee. The constituents of those members will judge severely on what seems to be of a very demoralising character. I hope the question will be sent back to the Committee by a very large majority.

Dr. GLADSTONE (Chairman of the Stores Committee): Mr. Buxton says that we should write a letter to the publishers, stating our grievance. He does not say that we are doing wrong, but thinks it would be a more discreet and more cour-

teous matter to send a letter in accordance with his amendment, instead of the one now proposed by the Committee to be sent. When the letter of the publishers was first received by us it did seem that we should reply and give our reasons. We then thought it better to ask the publishers to come before the Committee. The representatives of three large firms came with the Secretary to meet us. Having conversed with them for some time, at a satisfactory interview, it was decided that it was unnecessary to write a letter of the kind suggested by Mr. Buxton, and the matter was then brought before the School Management Committee, which resulted in the recommendation now before the Board. I am of opinion that it would be better to give a reply in a courteous manner; and it was in that spirit that I had prepared a letter prior to the decision of the Committee being arrived at. I shall vote, therefore, on behalf of the Stores Committee, to accept the proposal of Mr. Buxton. Dr. Wainwright says that we have not answered the remarks of the publishers' letter in our proposed reply. When these publishers met us they never employed these arguments. I believe that Her Majesty's Inspectors are entirely forbidden to approve any particular book, and are required to approve only the particular methods of teaching. But the proposal of the publishers is that we should throw aside all our influence and control over the teaching in the schools by allowing the teachers to use any kind of book, as well as to employ any particular method. I would not do the one nor the other; for it is our duty not only to secure good teachers, but also good books and good apparatus, failing which we should neglect our duty to the children. We, nevertheless, wish the teachers to have the right of selection within limits which we have laid down. Miss Taylor has inquired whether three or four members of the Board can possibly be as capable of judging of the nature of the books as the teachers are. I have no hesitation in saying that there are some members of the Committee who have far more experience on these matters than all the head-teachers. Some of those members have a speciality for drawing, others for reading; and according to their particular talents the books are distributed amongst them for perusal before they are accepted or rejected. Mr. Diggle asked whether the publisher who offered money to some of our teachers has had his name removed from the list. That name has not been removed: but a member of the Committee has given notice of motion on the Business Paper for consideration of the case at the Committee-meeting to-morrow. Respecting the champagne supper, of which we knew something three months ago, I believe it is not an unusual thing. It is a case common in the trade, but we have good reason to question whether the head of the firm knew of this practice which was being carried out by one of their representatives.

The Rev. J. R. DIGGLE repeated his second question, asking whether a certain publisher, who had given a champagne supper with the intention of securing the recommendation of teachers for his books, had been struck off the list.

Mr. ROSS: I rise at once to oppose the attack made by Mrs. Westlake upon some of the small publishers. I venture to say that small publishers can serve the Board as well as large ones can, and I question whether small publishers would go to the expense of champagne suppers, which would pay the larger publishers much better, on account of the greater returns made in their trade. I think that we should encourage the small publishers, for I am of opinion that there is not a more respectable class of men in the metropolis.

The Rev. G. M. MURPHY: I have endeavoured to support the policy of the Board, but whether we are degenerating or not I do not know, but if such matters are possible that are hinted at, it is time a radical change were made. Mr. Diggle asked whether some publisher had lent money to teachers and backed bills for teachers. Dr. Gladstone's answer went only that it was possible. There is a more serious matter connected with this than the mere giving of a champagne supper. I do not look at it from the temperance point of view. I attended a meeting the other day at the Society of Arts, where many of our teachers were present, when it was stated that something like that now mentioned was carried on on a very large scale even within our schools. It is a sad thing for people having the care and education of children to be open to these charges. I should have thought that it was a matter that was impossible; and, if true, it is derogatory to their character, and a disgrace to the School Board for London. Unless these names are removed from the requisition list, the School Management Committee will fail in their duty, for the tempter is worse than the tempted, and I hope that the School Management Committee will deal with the matter strongly. It is an under-current of things that certainly ought to be frowned down upon by every honest man and every honest woman. I hope the School Management Committee will be able to repudiate this conduct on the part of the teachers. While in a school in Finsbury, some time ago, I found a book which I was told had been written by one of Her Majesty's Inspectors for that Division. A more unsuitable book for our schools could not be found.

MISS SIMCOX: I hope the Board and the Store Committee will not be persuaded to look upon this matter as a piece of patronage to be dispensed. Our object is to provide the best possible books for our schools. I do not think that publishers of the kind in question are likely to produce the best books; but at the same time it is quite possible that a good book may be published by publishers who are not respectable. I think we should not strike off a book which would be useful to the schools, on account of the character of the publisher. A a matter of retribution, it would be satisfactory to strike off all the books published by tradesmen of this class. I am of opinion that there is no business done in a more satisfactory manner than that which is done by the Stores Sub-committee, under Dr. Gladstone; we may trust that Sub-committee to select the books on their merits; for it would be disastrous to do anything which would interfere with the honourable work of that Committee.

The Hon. LYULPH STANLEY, M.P.: I think that the general feeling of the Board will be that it is not desirable to abandon the control and criticism of the books supplied to us, and that it would not be well to throw open the list to all publishers. As to one of the publishers, who is said to have lent money, that case I understand is coming before the Store-Committee to-morrow, when the publisher will attend the Committee. As to the other matter, the charge of bribing and treating teachers with champagne suppers (or it may be 'supper, for very often the 's' gets in), I understand that it was done by one of the travellers of a firm, and there is no evidence that it was with the cognizance of the firm. Our first duty is to make a selection of books, and to choose the best ones. Mr. Diggle shakes his head, but these matters are to some extent new to me, for I have not been able to attend this Committee regularly, on account of other duties. I agree with Miss Simcox that our first duty is to make our selection for educational purposes, and to choose the best books. I do not agree with Miss Simcox that the selection of one particular book is of such paramount importance over all other books that we need retain the name of its publisher on the list. However, I would suggest that we should give the publisher referred to the opportunity of parting with his representative, or of having his books struck off the list.

Mr. ROBERTS: I listened with astonishment to the half-hearted way in which Dr. Gladstone spoke of the firm who gave the champagne supper. I hope we shall hear from Dr. Gladstone that he is prepared earnestly and energetically to inquire into the whole of the circumstances, for there is nobody who, more than Dr. Gladstone, objects to such proceedings as we have heard of to-day. It was a great pleasure to listen to the speech of Mr. Murphy, and it is the spirit in which all the members of the Board should deal with a question of this kind. I hope the Chairman of the School Management Committee, and the Stores Committee, will inquire earnestly into the matter. I am sorry to learn that a knowledge of this champagne supper should have existed three months ago; it is hardly what should have been allowed to exist. I hope Dr. Gladstone is prepared to investigate the matter so that no wrong may be done to the publisher and none be suffered by us.

Mr. SPICER: I hope care will be taken, and that justice will be done on all sides. Stories have been floating about in the trade for some time past. This is a kind of danger in which we almost naturally stand with regard to this kind of work, and it is simply impossible to give up the control. I believe that there are some publishers who would delight in this system of bribery; but the tendency of a Requisition List so put together is to create a trade monopoly; around trade monopoly corruption always clings. I would urge upon the Board the importance of throwing open that requisition list even more broadly than it is now. I would not take all books, but all those that come up to the full standard. Then anything which appears of this kind should be published to the full extent, so as to show to teachers that it is a dangerous thing—a blunder as well as a crime.

Mr. WILKS in reply: Mr. Spicer's suggestion is followed up literally and actually. There is no book shut out which is thought suitable in our schools. There is no way of extending the list except by making it a catalogue of every school book published at the present time. What will you do between these two things? We consider every book sent in (that is to

say it is considered by some competent person), and if the book is suitable it is put on the list.

(Dr. WAINWRIGHT here asked that the Finsbury book might be spoken of.)

Mr. WILKS: That is quite a matter of opinion as to whether the book is unsuitable or not. Mr. Frater tells me that the book is to be removed from the list, by order of the Committee. I would urge the Board to look to the general principle, and not to go off to the consideration of a matter of detail. Mrs. Westlake did not appear to make any aspersions on the teachers. If persons are placed in temptation such as she referred to, some of them may fail, and therefore they—both men and women—ought to be protected against temptation. With reference to the question put as to why the name of the publisher who had given the champagne supper had not been removed from the list, seeing that the fact was known to the Committee three months ago, the explanation is, that it has been difficult to verify the statement. I have heard of it in the way of trade. There is a certain amount of festivity going on. I could not bring it before the School Management Committee, for I could not put my finger on the firm. Mr. Spicer is well experienced in the trade, but he could not put his finger on the firm. We made inquiries privately; but when it was decided, after receiving the memorial, as a deputation was coming, we thought fit to defer the inquiry until that deputation should have arrived, when we might put questions to them. We put our questions to the deputation: and they smiled, the Secretary stating that they knew nothing about it. With respect to Mr. Diggle's statement, he need not think that we are careless about the morality of the Board. To-morrow the matter will be before the Stores Committee. I communicated with the publisher in question; and he, at his own wish, will attend the Sub-Committee to-morrow.

Mr. ROSS: I ask the question whether the publisher who has been guilty of the transaction does not do the largest trade with the Board?

Mr. WILKS: No; he does a very small trade with the Board, as Dr. Gladstone will testify. Of the number of reading books used by the Board, the order going from the highest to the lowest, is almost determined by the degree of ease with which the reading books can be got through. The easiest book is ordered in the largest numbers.

Mr. DIGGLE: Is it a fact that only a fortnight ago the Committee were in possession of the name of the publisher who gave the champagne supper?

Mr. WILKS: No.

Mr. Sydney Buxton's amendment was then accepted; and it was accordingly referred to the Committee to prepare a draft answer to the memorial of the publishers, and to present it to the Board for approval.

Mother-Teachers.

BY JOSEPH HUGHES.

(*Reprinted from 'The Governess.'*)

PROBABLY many of our readers will be surprised when they see the title of this article—'Mother-Teachers.' We must be candid, and say outright that we approach this subject with pain—pain that any respectable *man*, never to mention that that man is addressed as *reverend*, could be found to submit a motion to the London School Board of the nature of that which the Rev. T. Morse advocated at a recent meeting of that body. This worthy gentleman is the new vicar of Christ Church, Newgate Street, and has been pleased to ask the Board not to appoint any married woman as a teacher 'within two years after she has given birth to a child'; and he also further prays that 'teachers be required to resign their appointments five months before an expected confinement.'

We should like to know upon what grounds Mr. Morse arrogates to himself the right to dismiss teachers under the conditions which he specifies.

So long as teachers, be they men or women, *are of blameless character, and do their school work efficiently*, we hold that it is an impertinence on the part of any one, to pry into their domestic life, to inquire whether they worship at church or chapel, or vote for the Tory squire or the Liberal tradesman. These are the common rights of a citizen, apart altogether from school life, and any curtailment of them is a violation of the first principles of true liberty.

We presume that the London School Board's primary aim, when engaging their staff, is to secure the highest intellectual training for their children, at a minimum cost.

On the latter part we need not dwell, as *that* end is gained by the employment of women. And who, we ask, is so fit to teach our daughters, and the little darlings so dear to our hearts, as a trained woman, with her wealth of sympathy, her untiring patience, and her innate love for little children? Certainly not man.

An unmarried lady may, and in thousands of cases does, make an excellent teacher, but no observant individual would dare to say that she would not make a still better teacher after she had experienced a mother's love for her own children. By becoming a mother her sympathy with the young—the pre-eminent qualification of a good teacher—is widened and deepened. Perhaps Mr. Morse objects to retain the teachers on physiological grounds. Fortunately for London teachers, there is a lady on the Board who has made this subject her special study. We allude to Mrs. Fenwick Miller, than whom there are few women living better able to give a just judgment on this subject. In her the teachers have a true friend. At a meeting held recently at Saffron Hill she spoke on behalf of the teachers, and also urged that if this motion were adopted it would injure our schools, 'both by removing a large proportion of the best teachers, by causing incessant changes of staff, by preventing clever girls from choosing teaching as the profession of their lives, and by taking away from the children precisely the teachers best qualified by their maternal experiences to manage and guide them.' Upon the moral aspect of this delicate question we do not care to linger. Surely Mr. Morse would, not put a premium on the very worst kind of vice. It practically amounts to this, that if many of the married women are to retain their positions as teachers under the Board, they are (speaking figuratively) to shake hands with a woman who has thrown in her lot with the champion of infidelity, and whose publications most right-minded people consider a disgrace to her sex and her country. Why interfere with the laws of nature? Out upon such prudery! For a womanly *woman* we have the highest admiration, but for a womanly *man* we have—well, we had better not set down our opinion.

The grossest injustice would be done to our

fair friends who have just entered the profession, to those who are in it, and to those who have left it and may wish to return, if this monstrous motion were to find favour with the Board. In conclusion we will cull a chapter from a teacher's life, which has a significant bearing upon this most important question. Some years ago a lady who had been an elementary teacher married a professional man. For a long time all went well as the proverbial marriage bell. By-and-by, however, sickness came, and with it a reverse of fortune. The bread-winner was stricken down, and scarcely expected to live. Olive-branches had in the meantime sprung up quickly, and there had been but little chance of saving. What was the wife and mother to do? With a decision of character and a heroism worthy of her sex, she gave her husband most of the savings, and booked his passage to a kindlier clime. Bracing herself up for a supreme effort, she applied for and obtained a school under the London Board. She kept the home together, *buried a baby in her husband's absence*, and to-day, though her partner has returned with a fresh lease of life and is doing well, she is one of the most respected and successful teachers engaged by the Board. We honour a nature so heroic. And yet these are the women Mr. Morse and Mrs. Westlake—for this lady seconded the motion—seek to rid the Board of.

How many teachers are helping widowed mothers, sick sisters, and unfortunate relations, who would not only be deprived this blessed luxury, but would be thrown almost penniless on the world were this objectionable motion passed!

Surely the teacher's struggle in life is severe enough, without having it further embittered by the imposition of artificial and obnoxious restrictions.

Monthly Notes.

THE METROPOLITAN BOARD MISTRESSES ASSOCIATION.—The first general meeting of this Association was held on April 28th, at the Saffron Hill Board School. There was a large attendance, nearly 200 ladies being present. Mrs. Hayter took the chair and called upon Mrs. Fenwick Miller, M.L.S.B., to move the first resolution, which was as follows:—

'That this Association of Metropolitan Board Mistresses (head and assistant) is formed for the purpose of mutual advice and support, and is open to single as well as married mistresses.'

Mrs. Fenwick Miller said that the circumstances which had led the women teachers of London to see the desirability of forming an Association which should be to gather up facts and represent them as might be needed, was the following resolution of the School Management Committee:—

'No married woman shall be appointed as teacher who has given birth to a child within two years from the time at which such appointment is under consideration. After the 1st of January, 1882, any mistress in the service of the Board shall vacate her appointment within five months from the probable date of an expected confinement.'

This proposition was moved on the Committee by the Rev. T. Morse, and seconded by Mrs. Westlake. The Board, however, rejected the proposal by nineteen votes against fourteen. Such a proposition had been made several times before, and, in view of the possibility of its renewal in the future, some of the married mistresses had met together to consider what steps they might take, and from this beginning the Association had grown so rapidly, that they might hope it would be of the greatest aid to women teachers, in many ways, in time to come. She believed that it would be a grave mischief to the schools if such a proposition were ever carried into effect. She contested the statement that women about to have children were *ipso facto* unable to work, and gave instances from her own medical practice, of the great differences shown in the capacity of women, in different ranks and habits, to overcome the fatigue at such times. She denied, however, that the Board had any right, moral or economical, to go behind the results obtained by a teacher, to inquire into the teacher's state of health and domestic affairs. If the school were in a bad condition, it was the duty of the Board to dismiss the responsible teacher; but, if in good condition, the Board had no business with whether the teachers had headache, or gout, or children. The schools must suffer from the removal of married teachers.

Mrs. Legge seconded the resolution, which was carried unanimously. A resolution naming the officers for the ensuing year, and giving the committee authority to add six unmarried mistresses to their numbers, was moved by Miss Helen Taylor, seconded by Mrs. Usherwood, and carried. Votes of thanks to Mrs. Fenwick Miller and Miss Helen Taylor were proposed by Mrs. Curtis and carried very heartily, after which the meeting broke up. Any particulars respecting the Association may be obtained from Mrs. Usherwood, Thomas Street Board School, Limehouse.

THE HIGHER EDUCATION OF WOMEN.—IT has long been a grievance with female students at our universities that they have in most cases no means of showing the honours they have obtained, except by a lengthy and unsatisfactory title, such as 'First Class Honours, Higher Local,' or 'Second Class History Tripos, Cambridge.' We have great pleasure, therefore, in drawing attention to the fact, which will be doubtless new to many of our readers, that the University of St. Andrews, N.B., grants—and has done so since 1877—the degree L.L.A. (which we presume means Lady Licentiate in Arts) to those of its female students who satisfy the Examiner in a certain course of subjects. This is, we are convinced, a move in the right direction, and we only hope that other universities will follow the example of their northern sister.

The following items of interest are taken from the Syllabus, to which we must refer those of our readers who desire further information on any point:—

1. There is no limit as to age in the L.L.A. Examination.
2. After 1883 no Candidate will be admitted to the St. Andrew's L.L.A. Examination who does not hold the Local Examination Certificate of a University. Those, however, who have entered for Examination in or before the year 1883, but have not obtained the title, may complete their Examination in any subsequent year.
3. The present centres for Examination are *St. Andrews, Edinburgh, Aberdeen, London, Halifax, Bristol, and Belfast.* The next Examination will be held on the 16th, 17th, 18th, and 19th of April, 1883; and those who intend to become Candidates (whether they have passed in any subjects previously or not) are requested to intimate the fact to *Professor Knight, the University, St. Andrews*, not later than the *1st of March*, 1883. Thereafter, a 'Form' of application will be sent to them to be filled up, signed, and returned to Professor Knight not later *than the 15th of March*, 1883.
4. In each subject there is a Pass and an Honour Standard.

The subjects mentioned in the prospectus are English Language and Literature; French; German; Italian; Latin; Greek; Mathematics; Natural Philosophy; Chemistry; Mineralogy; Physiology; Botany; Zoology; Geology; Physical Geography, and Palæontology; Logic and Metaphysics; Moral Philosophy; Education; Politi-

cal Economy; Comparative Philology; History; Theology; Biblical Criticism; Church History; and Hebrew.

5. Any Candidate who passes in five subjects (one at least being a language), or who gains honours in one subject, and passes in other three (one of the four being a language), will receive the title of L.L.A. English counts as a language in this Examination, if the Honours subjects are taken in it. To women who propose to become teachers, this title is equivalent to a diploma, or licence to teach, in the subjects in which they have passed, or taken honours. Candidates entered before 1883 are only required to pass in four subjects.

6. The standard of attainment both for Pass and Honours is the same as that required for the M.A. degree in the subjects included in the University curriculum,—the books prescribed, the questions set, and the hours of Examination, being identical; and in the subjects not at present included in the University curriculum, the standard required is analogous.

Since 1877 no less than 676 candidates have entered for these examinations. Of these 547 passed in one or more subjects, and 145 received the title of L.L.A.

UNIVERSITY OF LONDON.—The annual presentation of students for degrees at this University was held on the 10th May, at Burlington House, Piccadilly. Sir George Jessel, Vice-chancellor of the University, presided, in the absence of Earl Granville, who was unavoidably prevented from attending. After the distribution of the prizes and exhibitions to the graduates and under-gaaduates, amongst whom were several ladies, the Chairman said that this was the first time the diplomas and prizes of the university had been distributed by a graduate. He had been a member of the university for more than forty years, and during twenty years of that period he had had the honour of serving the university as a member of the senate. The progress of this university had been somewhat remarkable, for it continued to increase, so far as the number of graduates was concerned, and if it continued to increase in the same ratio, even their large hall would be insufficient to accommodate the number of pupils. The benefits of the university had been extended not only to the colonies and dependencies, where they had held examinations, but also in other ways—he referred to the admission of women to degrees. No experiment could have proved more successful. London had been the first university to introduce the sciences in the ordinary examinations for matriculation and degrees, and to introduce degrees for science. Their object was to make boys and girls good men and good women in every sense, morally, intellectually, and physically, and to secure to them a kind of knowledge that would be useful to them in after life. After a few words by Sir John Lubbock, the proceedings terminated.

Training Colleges.

GENERAL EXAMINATION, 1881.

SECOND YEAR.

FEMALE CANDIDATES.

Grammar and Composition.

Three hours allowe for this Paper.

Every Candidate *must* perform the exercise in Composition.

Questions on *one only* of the three following pages may be answered.

Composition.

N.B.—This exercise must not extend beyond this page, but it may occupy all the blank space available.

Write in plain language an essay on *one* of the following—

Music; Pet animals; 'Knowledge is power'; Any well-known and exemplary female character.

GRAMMAR.

Three *bowshots* far
Paused the deep front of England's war,
And *rested* on their arms awhile
To close and rank *their* warlike file,
And *hold* high council, *if* that night,
Should view the strife, or dawning *light*.
O gay yet fearful to behold,
Flashing with steel, and rough with gold,
And bristled *o'er* with bills and spears,
With plumes and pennons waving fair,
Was that bright battle-front! for there
Rode England's king and peers.
And *who, that saw that* monarch *ride*,
His *kingdom* battled by his side,
Could then his direful doom *foretell?*
Fair was his seat in knightly selle (saddle),
And in his sprightly eye was set
Some spark of the Plantagenet.

SIR WALTER SCOTT.

1. Express the above passage in clear and simple prose.

2. Parse the words in italics, and analyse the first six, *or* the last six, lines.

3. Make a list from the above lines, of (*a*) nouns, and (*b*) adjectives, both formed from nouns;—and explain, when necessary, the method of formation.

4. What information can you give about the author?

As a swarm of bees in vintage time
About the wine-press *where* sweet must is poured,
Beat off, *return* as oft, with humming sound:
Or surging *waves* against a solid rock,
Though all to shivers *dashed*, th' assault anew,
Vain *battery!* and in froth and bubbles *end;*
So Satan, whom repulse upon repulse
Met ever, and to shameful silence *brought*,
Yet *gives* not *o'er*, though desp'rate of success,
And his vain *importunity* pursues.—MILTON.

1. Express the above passage in clear and simple prose.

2. Parse the words in italics; break up the passage into its component sentences, showing their relation to each other, and give a detailed analysis of the last four lines.

3. Explain, and give illustrations of, the difference between *similes* and *metaphors*. Which of these figures is employed in the above passage?

4. What information can you give about the author?

'*That* the dead are seen *no more*,' said Imlac, 'I will not undertake to maintain against the concurrent and unvaried testimony of all ages and of all nations. There is no *people*, rude or learned, among *whom* apparitions of the dead are not *related* and believed. This opinion, which prevails as far as human nature is diffused, *could* become universal *only* by its truth. Those *that* never heard of one another would not have agreed in a tale *which* nothing but *experience* can make credible. That *it* is doubted by single cavillers *can* very little weaken the general evidence; and some who deny it with their tongues *confess* it by their fears.' DR. JOHNSON.

1. Express the above passage in clear and simple prose.

2. Parse the words in italics, and analyse from the beginning down to "truth," or from thence to end.

3. Make a list of words in the above which are *not* of Anglo-Saxon origin, and give their derivations.

4. What information can you give about the author? What peculiarities of his *character*, and of his *style*, may be illustrated by the above passage?

School Management.

Three hours allowed for this Paper.

The questions on School Registers, at the end, MUST NOT BE OMITTED BY ANY CANDIDATE. Not more than EIGHT questions may be answered.

1. What should be the staff of teachers for a school of 200 scholars? If you had two pupil teachers, one of whom was in her first, and the other in her third, year, what duties would you assign to them respectively? Make a complete Time Table for the work of the Fourth Standard.

2. Make a list of words which present exceptional difficulty in spelling. Show how you would group them together, and by what sort of exercises you would fix the true spelling on the memory of the learner.

3. What rules would you give to pupil teachers on the art of putting questions, and what form of questioning is likely to prove

most stimulating and useful to learners? How far do you think it desirable to encourage in your class the habit of mutual interrogation?

4. Give the dimensions of school and class-room adapted for 250 girls; and a list of the principal fittings and furniture required. Say whether you think it desirable to provide standing as well as sitting room for the scholars, and if so, why and when you would use it.

5. Give some rules for securing (*a*) clear articulation, and (*b*) expression, in reading. Say also whether you know of any other means, apart from ordinary school reading lessons, of promoting taste, thoughtfulness, and a fondness for reading.

6. What instructions would you give to a pupil teacher as to the best mode of conducting a writing lesson? Refer especially to (*a*) the use of the black-board, (*b*) the use of pencilled lines for tracing, and (*c*) the prompt detection and correction of mistakes.

7. Give a sketch, with an illustration, of a first explanatory lesson on Descending Reduction? Show also by what sort of oral or mental exercise it is well to prepare a class before giving such a lesson.

8. What is the use of learning 'English Grammar.' in elementary schools? Explain by what other exercises than those in pure Grammar, you can enlarge the vocabulary of scholars, and help them to a knowledge of the formation, relations, and right use of words.

9. In teaching Geography, why is it necessary or desirable to 'begin at home?' Illustrate your answer by giving a sketch of a lesson on the geography, physical and topographical, of the place in which you have lived, and of the country in which it is situated.

10. What is the meaning of the word 'Science,' and what departments of science fall properly within the limits of an elementary school course? Is it possible to give truly scientific lessons without using hard or technical terms? Illustrate your answer by an example.

11. Suppose the following passage occurred in the reading lesson of a higher class, what words would you select for special explanation; how would you explain them; and what additional information would you introduce in order to make the whole passage fully intelligible to your scholars?—

'The most popular of all English poems has been the Puritan epic of the "Paradise Lost." Milton had been engaged during the Civil War in strife with Presbyterians, and with Royalists, pleading for civil and religious freedom, for freedom of social life, and freedom of the press. At a later time he became Latin Secretary to the Protector, in spite of the blindness which had been brought on by the intensity of his study. The Restoration found him of all living men the most hateful to the Royalists, for it was his "Defence of the English People" which had justified throughout Europe the execution of the king. Parliament ordered his book to be burned by the common hangman; he was for a time imprisoned, and even when released he had to live amidst threats of assassination from fanatical Cavaliers. To the ruin of his cause were added personal misfortunes, in the bankruptcy of the scrivener who held the bulk of his property, and in the Fire of London, which deprived him of much of what was left. As age drew on, he found himself reduced to comparative poverty, and driven to sell his library for subsistence.'

School Registers.

12. What particulars should be inserted in the Admission Register, and how often should names be removed from it? What is the value of a 'Summary,' and what statistics should it contain?

Give a specimen of a Class Attendance Register with ten names for one week, and show how each of these particulars should be marked and calculated:—(*a*) presence and absence; (*b*) school holiday; (*c*) leaving school before the expiration of two hours' secular instruction; (*d*) correction of previous mark; (*e*) percentage of absence for the week; (*f*) number of attendances; (*g*) average attendance.

British History.

Three hours allowed for this Paper.

No candidate is allowed to answer more than *eight* questions.

1. What parties divided the English nation at the death of Elizabeth? What expectations had each from her successor?

2. Describe the origin and progress of our Colonies in North America.

3. Trace the action of the successive Parliaments of Charles I., and state the provisions of the Petition of Rights.

4. What part did the Scotch take in the quarrel between Charles I. and the Parliamentarians?

5. State some of the measures taken by Cromwell for the government of Ireland.

6. At the Restoration, what great questions immediately occupied the attention of the Convention Parliament, and how were they settled?

7. Describe the First, and the Second, Declaration of Indulgence issued by James II., and state some of the effects of each.

8. What impediments to the Revolution of 1688 occurred in Ireland and in Scotland? And how were they met?

9. Name some important social events, with dates, that occurred in the Stuart Periods, and give a brief account of English life at that time.

10. What was the basis of the claim of the House of Hanover to the Throne of England? Trace the descent from James I. (of England) of the first Sovereign of that line.

11. Give an account of 'The Fifteen,' 'The Triple Alliance,' 'The Quadruple Alliance,' in the reign of George I.

12. Describe fully the circumstances of the conquest of Canada.

13. What celebrated authors and artists lived in the reign of George III.? Give some account of two of them.

14. Describe the careers of Warren Hastings and John Churchill, Duke of Marlborough.

15. Name the principal political and social changes made in the reign of William IV., and describe one of them.

Geography.

Three hours allowed for this Paper.

No candidate is permitted to answer more than *eight* questions; or draw more than one map.

1. The British Isles are farther north than Lower Canada, but the climate of the latter presents extremes of cold unknown in the former, and is drier and less windy. How do you account for the differences?

2. How are islands formed? Give examples. Explain very clearly what an atoll is, and how it is formed. Where are atolls found?

3. Describe briefly the main characteristics of Europe, as regards its physical features, climate, and animal and vegetable life.

4. Describe fully the boundaries, physical features, productions, population, and form of government of Cape Colony.

5. A person starts from Calcutta in a ship for Melbourne, and stops at every English possession in the Malay peninsula and on the island south of it. Where does he stop? Mention anything of interest he would see.

6. Draw a map of New Zealand, marking the different colonies, with their capitals, and the principal physical features of the coast line. *Or*, of the South and West of Australia, giving the same particulars.

7. Arcot, Nellore, Juggernaut, Hyderabad, Allahabad, Agra, Masulipatam, Delhi, Rajpootana, Hurdwar—Give the respective situations of the above as exactly as you can, and mention any objects or circumstances of interest connected with any of them.

8. What articles of food does England import from India, Newfoundland, Australia, and Canada respectively? and what articles are exported from England to those places? Tell what you know about the method of production of any one of them.

9. The Austrian Empire is a combination of several nationalities. Name them, with the places which they inhabit. What is the form of government in that Empire? Mention any peculiarity in the position of the sovereign.

10. Where are Bulgaria, Eastern Roumelia, Servia, Roumania, situated? Name their capitals, religions, and productions, and mention the empire of which they once formed a part, stating, if you can, when they were separated from it.

11. Name, in order, the *principal* rivers, openings, capes, on the coasts of Italy and France. Give the names and situations of their chief sea-ports, with their populations and chief objects of trade. Draw a map of either of those countries, showing the mountain and river systems, besides the particulars above required to be described.

12. Where are Varna, Astrakhan, Riga, Fribourg, The Hague, Königsberg, Dresden, Mayence, Leipsic, Corfu, Ivica, Palermo, Ravenna, Toulon, Lepanto? For what are they respectively remarkable?

13. Draw a map of the Baltic Sea, marking the countries on its shores, its openings, islands, rivers, and chief ports.

14. Draw a map of New Zealand, *or* British North America, *or* South Africa.

Arithmetic.

Two hours and a-half allowed for this Paper.

No candidate is permitted to answer more than *ten* questions. The *solution* must be given at such length as to be intelligible to the Examiner, otherwise the answer will be considered of no value.

1. Find the value of 10 tons 14 cwt. 1 qr. 4 lbs. at £17 14s. 8d. per ton.

2. What will be the cost of laying turf on a lawn 30 yds. 2 ft. 6 in. long, and 10 yards 1 ft. wide, at 2s. 3d. per square yard—two flower-beds, 10 ft. long by 8 ft. wide, not to be turfed?

3. I sell tea at two prices, one being 50 per cent. higher than the other. A customer ordering 1 cwt. of each kind, I sell him the 2 cwt. for £38 5s. 4d., cheapening the better tea 20 per cent., and the inferior tea 15 per cent. What are the ordinary prices of my two teas respectively?

4. Multiply 395·68 by 4·804:—from the product subtract 1525·95, and divide the remainder by 156·337.

5. I lent a friend a certain sum 28 years ago. He has just paid me £866 5s., that being the principal and simple interest on my loan to him at the rate of 3 per cent. for 10 years, and 3½ per cent. for the remaining ten years. What was the amount lent?

6. The diameter of the fore wheel of a bicycle is 4⅞ that of the hind wheel, and the former makes 352 revolutions in travelling a mile. How many revolutions does the hind wheel make in a mile? and what is the circumference of each wheel?

7. What would be the gross rental of an estate for which the owner received £744 18s., after a deduction of 6d. in the £ for income-tax, and 4½ per cent. on the remainder for collecting had been made?

8. A schoolmistress receives £58 a year guaranteed salary, and ⅓ of a Government grant, averaging £59 10s. Her salary is subsequently increased by 7½ per cent., and the Government grant rises 11¼ per cent. What is, then, her income?

9. Find the average of the six following numbers:—$\frac{19}{180}$, 8½, 15⅓, ·08, ·001, ·893.

10. Two persons buy respectively with the same sum of money into the 3 per Cents., and into the 3½ per Cents., and get the same amount of annual interest. The 3 per Cents. stand at 75; what do the 3½ per Cents. stand at?

11. The owner of $\frac{4}{17}$ of a ship sold $\frac{3}{11}$ of $\frac{2}{5}$ of his share for £12$\frac{4}{33}$; what would a share equivalent to $\frac{2\frac{2}{3}}{4\frac{4}{9}}$ of $\frac{3}{5}$ of the ship cost at the same rate?

12. If the 3 per Cents. are at 92¾, and the 4 per Cents. at 123¼, what must be the amount invested in each in order that the difference of income arising from the two investments may be one shilling?

13. What is meant by *discount?* Find the *true* discount on £1,336 11s. 3d., due at the end of 3½ years, at 5 per cent. per annum.

14. Find the compound interest for £120 for 3 years at 3½ per cent.

15. A invests £457 10s. at compound interest for 3 years at 4 per cent.; B invests £477 10s. at simple interest for the same time, at the same rate. How much more will one receive than the other?

Domestic Economy.

Three hours allowed for this Paper.

No candidate is permitted to answer more than *eight* questions.

1. What facilities are offered by the Government to small investors in order to enable them to save? Describe one of them fully.

2. What are building societies and co-operative stores? On what principles are they conducted, and what are their advantages and disadvantages?

3. English cookery among the poorer classes is generally considered wasteful. Give any examples you know in proof of this, and suggest any remedies that occur to you.

4. How would you conduct a cookery class? How can the dishes, when cooked, be most advantageously used?

5. What are the changes that food undergoes from the time it is eaten till it is absorbed in the system?

6. Name any filters you may be acquainted with for purifying water. Describe the one you think best, and state its cost.

7. What are the symptoms of measles, scarlet-fever, and small-pox? Describe the treatment in each case.

8. Describe the process of vaccination. On what grounds do some people object to the efficacy of vaccination?

9. Write notes of a lesson on the choice of a dwelling.

10. What is a penny-bank, and how should it be worked in connection with a school?

11. 'All disinfectants act chemically. They either decompose or they combine with the noxious substances, and produce new compounds, which, if not void of smell, are comparatively harmless in their action on the human body.'

Mention a few of those which are most efficacious and most easily accessible, and state the manner in which they should be used in cases of infection.

12. Describe the course of needlework and knitting exercises adapted for infants, and for Standards I., II., and III. Say how you would graduate your early lessons in hemming; and whether any diagram or other illustration shown to the whole class would be useful, in addition to individual help and guidance.

FIRST AND SECOND YEARS.

FEMALE CANDIDATES.

Dictation.

For the Examiner.

One passage is given for candidates of both years.

The passage should be read *once* distinctly, and then dictated *once*, in portions as marked.

If the room is large, and there is danger of your not being heard at its extremity, you may permit one of the officers of the college to stand half way down the room, and repeat the words after you, exactly as you give them out.

It is essential that there be no complaint on the part of the candidates that they could not hear or understand: you can prevent this only by clearness, accuracy, and audibility.

The contests of parties in England | had long been carried on | with a ferocity | unworthy of a civilized people. | Sir Robert Walpole | was the Minister | who gave to our Government | that character of lenity | which it has since generally preserved. | It was perfectly known to him | that many of his opponents | had dealings with the Pretender. | The lives of some were at his mercy. | He wanted | neither Whig nor Tory precedents | for using his advantage unsparingly. | But, with a clemency | to which posterity has never done justice, | he suffered himself to be thwarted, | vilified, | and at last overthrown, | by a party | which included many men | whose necks were in his power.

Mental Arithmetic.

Twenty minutes allowed for this Paper.

You are to enter the answer in the space left for it after each question. Nothing is to be written on this paper, except the particulars required in the above table, and the answers (which must be written in ink) to the questions on the other side. No erasures or alterations are permitted. They will be marked as errors.

1. (196 ÷ 14) × (31 − 24) =
2. Paid 3s. 8½d.; 7½d.; 5s. 10½d.; 7s. 3½d.: what had I left out of a guinea?
3. 880 articles at 9s. 11½d. each =
4. How many guineas in £672?
5. 320 dozen at 2⅜d. each article =
6. Receiving £109 10s. a-year (365 days), and spending £54 15s.: what can I save per day?
7. Reduce 9s. 9d. to the decimal of £1.
8. How much is £·15625 in shillings and pence?
9. 127½ ÷ 10⅛.
10. (½ + ⅓ + ¼) cwt. at £60 per cwt. =
11. Find L. C. M. of 9, 15, 25.
12. Gave 2½ lbs. tea at 2s. 6d. a lb. in exchange for 15 lbs. of sugar,—cost of sugar per lb. = ?
13. 11d. a day (omitting Sundays), how much per year (365 days)?
14. Simple interest on £500 14s. 7d. for two years at 4 per cent. per annum =

Alternative Paper.

1. (17 + 19) × (49 — 13) =
2. Paid 11½d, 6s. 1½d. and 2s. 6½d.: what was left out of half-a-guinea?
3. 360 articles at 19s. 11d. each =
4. How many guineas in £759?
5. 720 score at 1⅛d. for each article =
6. Receiving £54 15s. per year, and saving 1s. 6d. per day: what do I spend per year (365 days)?
7. Reduce 5s. 7½d. to the decimal of £1 =
8. How much, in cwts., &c., is ·5875 of a ton?
9. $28\frac{1}{2} \div \frac{3}{16}$ =
10. $(\frac{1}{2} + \frac{1}{4} + \frac{3}{16})$ of £1000 =
11. L. C. M. of 12 . 15 . 16 =
12. Gained 3s. 4d. on selling 5 lbs. of tea: sale of how many lbs. would gain £8 16s. 8d.?
13. £16 14s. 7d. per year (365 days): how much per day?
14. Simple interest on £380 2s. 7½d. for 1 year at 4 per cent. =

FIRST YEAR.

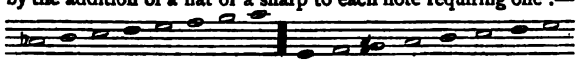
MALE AND FEMALE CANDIDATES.

Music.

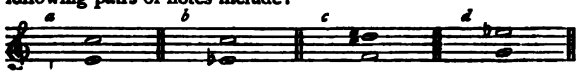
Two hours allowed for this Paper.

The Tonic Sol-fa questions are printed in Italic. Candidates must keep *entirely* to one set of questions or the other. *You are not permitted to answer more than* NINE *questions.*

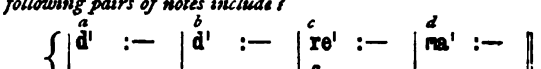
1. Complete the following as scales of A flat (*La*) and E (*Mi*) by the addition of a flat or a sharp to each note requiring one :—

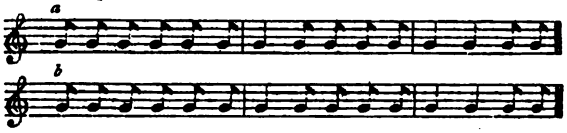


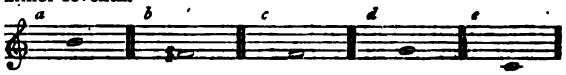
1. *Write an ascending and a descending minor scale, and mark the places of the tones and semitones.*
2. How many tones and semitones, or either, does each of the following pairs of notes include?



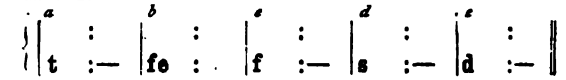
2. *How many tones and semitones, or either, does each of the following pairs of notes include?*



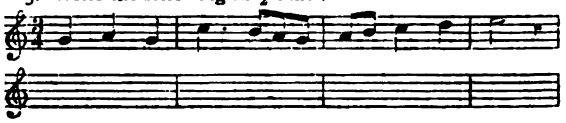
3. Group the following notes, so as to show *a* to be in $\frac{3}{4}$, and *b* to be in $\frac{6}{8}$ time:—

3. *Write two or more bars in three-pulse, four-pulse, and six-pulse measures, some bars to include rests. Give the time names to the notes so written.*

4. Add to *a* its major third; to *b* its perfect fifth; to *c* its major second; to *d* its pluperfect fourth (or tritone); and to *e* its minor seventh.

4. *Add to* a *its major third; to* b *its perfect fifth; to* c *its major second; to* d *its pluperfect fourth (or tritone); and to* e *its minor seventh.*

KEY C.



5. Write the following in $\frac{3}{4}$ time :—



(To be continued.)

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

V.

ERYSIPELAS—(*continued*).

IT is seen, therefore, that erysipelas may arise in a person prone to it without there being necessarily a seed, or germ, or potent factor, from an antecedent case; some always pre-existing germ having been hatched, so to speak, by abnormal and unusual conditions of the body, and then propagates itself, if circumstances favour it; particles from such a case may then be transferred from it to the tissues of another person. If these particles find damaged material in these tissues, such as are present when a cutaneous injury has been inflicted, and there is the usual reaction which follows injury, viz., an attempt to throw off the damaged tissue, erysipelas may be set up in that tissue, and it then spreads itself from that case to the inmates of the establishment, attacking any one who may happen to be wounded, even if it be only by a scratch. It is very necessary, therefore, when a case of erysipelas arises in a school, that the same rules be adopted for isolation and disinfection as are used against scarlatina or measles, and thus now and then a serious mischief may be altogether prevented. It is not usual for all medical men to look upon erysipelas in the same light that I do, but evidence on this point is too strong to be much longer overlooked. I therefore urge managers to take the safe course, and act in the only way which can prevent the extension of the disease.

Boils.—It is not unusual to find several children in a given school to be suffering from a crop of boils, arising either at the same time or in rapid succession one after another. Boils may be described as hard, prominent swellings, with a deep redness in the surrounding skin, exceedingly painful, and eventually terminating in an imperfect kind of suppuration. They commence in two or three different ways. In one class, a slight itching begins in the skin, which, being scratched, the head of a small papule is taken off and a wound is thus made, from which a minute drop of serum, or blood, exudes; but very soon the base of the papule gets harder, and extends its borders, both on the surface and into the tissue of the cutis vera, or true skin, and spreads to the cellular tissue underneath. Several may appear at the same time. They may arise on the back and about the arms and the neck and legs; indeed, scarcely any part of the body is entirely free from their possible inroads. Another class commences in the cellular tissue beneath the skin, and the first knowledge of the commencement is the discovery of a lump, which is tender when touched. It may be some days before a blush of redness on the skin shows that it is about to break out and discharge. The third kind are deeper still, and form about the fundament and other loose parts, giving rise to abscesses of a considerable size. The figure of the ordinary boil is a small cone, the base of which is below the surface of the skin, and the apex is like the top of a volcano in miniature. This has a whitish speck, under which is a small depression. If the head is removed, a little dead cellular tissue is exposed, with a minute quantity of imperfect pus, or matter, and presently a little serous, or bloody fluid, is discharged. They are generally about the size of a sixpence in superficial area, but the surrounding redness may extend over a much larger surface, and the superficial hardness sometimes exceeds half-a-crown in diameter. They are exceedingly painful when they happen to be in the nape of the neck, or about the joints, as the wrist or armpit, or wherever the skin is liable to friction from the movements of the body or the limbs. In very young children they are often not nearly so painful. I have frequently seen boils of considerable size in teething infants without apparently any suffering attending upon them; but such kinds must be different altogether in character from those which commence in the cutis in the way I have mentioned, and which are capable of propagation from one to another. In some they come singly, and as one gets well another forms, and the crop is kept up for several months; in others a single boil is followed by a regular crop, many appearing together. In some cases they follow attacks of febricula or gastric and other forms of fever. I have seen an establishment in which typhoid fever has attacked several of the inmates, and boils have accompanied the cases, and after the typhoid has been removed some of those who did not suffer from

typhoid have suffered from a crop of boils, similar to those which appeared on the typhoid cases. They appear in the young as well as in the old, they attack the plethoric or the feeble, and no kind of constitution is certain to be free from their ravages. They are in a manner infectious, and capable of being transferred from one to another. It has happened to myself on several occasions, to have small boils upon my own arms when I have had to treat several other persons, and I have reason to believe that I have caught the disease from my patient; so that in the end I learnt caution, and took care not to get any of the discharges from boils or from their exaggerations, 'carbuncles,' upon any part of my own skin.

Sometimes they are very acute and rapid in their progress, at others they are indolent and slow. These latter have a more hardened base, and are much less painful than the acute variety. There is much difficulty in obtaining any kind of suppuration, and the hardness may remain for several weeks after they have ceased to discharge. Even in the acute form, after discharge has taken place, there is a hardness left behind, and whilst any part of this hardness remains in the cellular tissue, the patient is not free from the chance of a return of his complaint in some other place. The cause of boils is said to be some kind of cacozyme, which develops in the cellular tissue. It is doubtless of parasitic origin. Some excessively minute particles of degenerated protoplasm have been described by several writers, but the exact pathology has not yet been thoroughly worked out. It is very probable that they are connected in their origin with the introduction of some vitiated article of food, such as milk or butter, from a cow which has some defect in its constitution, or from some food which has not been cooked enough to destroy the parasitic germs which may possibly infect it.

Those boils which arise on the surface of the body, and then get deeper in, may be arrested by the action of tincture of iodine. If a drop or two be inserted in the itching papule two or three times in the course of the day, the majority of them will abort, and not develop into typical boils. The point of a stick of lunar caustic is sometimes used, but I prefer the iodine. If it is not successful in preventing the development, it is better not to continue its application for more than a day or two, but to leave the boil to take its course, covering it up with a little resin ointment, or yellow basilicon, as it is commonly called. A small portion of the ointment should be put on the top of the volcano, then a little fluffy cotton wool and a pad of cotton, shaped like a bird's nest; put wool over it, and keep it in its place by a loose bandage, a handkerchief, or a slip or two of adhesive plaster, so that all pressure may be taken off the sore, and friction altogether prevented. This kind of treatment is much more satisfactory than that which is so often used, viz., by poulticing the boil. It will always be noticed that a boil which has been poulticed for any time is certain to be followed by a crop of secondary boils around the first. It is also certain that the warmth and moisture which a poultice promotes places the surrounding skin in the most favourable position for the growth of the parasite, upon which I believe that the extension of the boil depends. I have given up the use of poultices for a long time past. Still, when the boil is close to one of the orifices of the body, and liable to be rubbed, it may be useful and very comforting to poultice for a few hours just before the time of discharge, if there is retained matter; but as soon as it commences to discharge, the poultice should be at once discontinued and the yellow basilicon applied. The ointment should be continued as long as there is the least appearance of discharge from the place. Some persons put a a piece of plaster over the boil and leave it alone altogether. It is a successful practice sometimes, after treating a boil with tincture of iodine for a day or two; and if the place shows signs of departure, it may 'speed the going guest,' and save it from friction and irritation; but to put a plaster on a boil which is really developing is an uncomfortable proceeding, and not nearly so satisfactory in its results as keeping the top of the boil moistened with yellow basilicon. If the place is small, a portion of chamois-leather soap plaster may cover it, first putting on a small piece of wool having ointment upon it covering the boil. In that case the plaster should be cut crossways just over the boil, so as to prevent any pressure upon the top of the boil itself. When they form in the neighbourhood of the fundament, the victim should keep in bed, and occasionally foment the part with a sponge wrung out of hot water. Boils in that position may be dangerous, and lead to other troubles.

It used to be the custom to lance boils. I have had them cut across with a crucial incision, and treated others in the same way. It is a barbarous custom, and does not help the case forward a bit, except in those which are indolent and will not suppurate, and are in awkward situations, as in the armpit or between the thighs. In any case, I think it bad practice to cut them crucially. It never does to produce a greater injury to cure a lesser one, and a great injury may be done by cutting into flesh which should not be interfered with. The surgeon may sometimes see the necessity for incision from the possibility of other mischief, such as may arise from pressure upon an important organ, or because there may be a tendency to extend in the deep tissues, especially those in the neighbourhood of the anus or armpit; but, except in such situations, it is far better to leave nature to perfect her own work, and to let the tissue in which the parasite has spread its venom be thrown off out of the body by natural means. Neither do I think it of any use to give medicine to those who suffer from boils, unless some function is improperly performed, or some evident defect of power is present. If there is foul tongue, loss of appetite, confined bowels, and other constitutional disorders, each symptom should be treated according to the rule which will be laid down hereafter for each departure from natural states. It is really useless to give the medicines which are sometimes highly recommended, such as yeast, porter, and wine. Such things don't really help the case. The general condition of the patient should be dealt with according as to whether 'he is well nourished or enfeebled and anæmic.' Quinine and iron, in some form or other, will be beneficial if the face is pale and the patient weak, and mineral acids may be useful, but they should be only prescribed under medical direction, and stimulants as a rule are worse than useless.

Carbuncle.—It is not unusual for a so-called carbuncle to develop out of an ordinary boil. The hardness at the base of the boil does not resolve itself in the usual manner, but vitality ceases in a large part of it, and it is thrown off as a slough, several holes ap-

pearing upon the surface. There is gangrene in the skin and the cellular tissue underneath, in consequence of a complete blockade of the circulation, through a number of the capillaries or minute vessels which supply the skin. This block is effected by a more extended development of the same or a parasite similar to that which gives rise to a crop of boils. The carbuncle may appear as a small speck at first, but it sometimes rapidly develops itself, especially in the nape of the neck, and often sets up serious mischief. If the place is only an inch or so in diameter, it may be treated precisely in a manner similar to that prescribed for boils, viz., with yellow basilicon and cotton wool. If there is much slough, it is a good plan to sprinkle upon it at each dressing a few grains of animal charcoal. This application destroys the foul odour which sometimes arises, and clears the wound imperceptibly of the slough and its disagreeables. It must be done carefully, otherwise it creates a black-looking patch, and tends to frighten the patient into a belief that there is general mortification. Carbuncles, as well as boils, easily bleed if they are rubbed, or if the slough is dragged away by violence. The core or slough should be allowed to separate without using any force, and if the hole which forms in consequence of the destruction of skin is filled with soft cotton, first applying on the place a little softened basilicon, it will be the best kind of treatment that can be used. When the place is excessively painful, it may be fomented occasionally with some hot water in which a few poppy heads have been boiled. Some prefer a poultice made with boiled carrots. It is useful when there is much slough, and may be applied for two or three hours a day with advantage, especially in those cases in which charcoal powder has been used. It is very important to keep a case of this kind very clean, and to burn up all the dressings which have been used or any rags which have been soiled.

(To be continued.)

—o—

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD, M.E.S.,

Joint Author of 'The Field-Naturalist's Handbook.'

No. XVII.—THE MONKEY TRIBE.

PART V.

THE Cacajao (*Pithecia melanocephala*), another of the Brazilian monkeys, may be easily distinguished from all the other American *quadrumana* by the black head, to which the specific title refers, and, more particularly, by the extreme shortness of the tail. This organ is of wonderfully small dimensions, occupying little more than five inches in a cacajao of adult size, measuring, perhaps, two feet six inches in total length.

For some years after this animal was discovered, the abbreviated tail was thought to be due to the attacks of other monkeys, who are much in the habit of nibbling the caudal appendages of their comrades whenever a convenient opportunity for so doing presents itself. Upon looking at a cage where a number of monkeys are confined together, we are sure to notice that the tails of the smaller and more weakly inmates are reduced often to half their proper dimensions, owing to the persevering attacks of their larger and more powerful brethren.

It has since been proved, however, that with regard to the cacajao, nature alone is responsible for the seemingly imperfect character of the tail, which appears never to occupy more than one-sixth of the entire length of the animal.

The head of the cacajao is of a rather peculiar form, the temples being flattened, instead of rounded, as is the case with monkeys in general.

With the exception of the head and the fore-paws, which are of a deep black, the fur of the cacajao is a bright yellowish-brown. The ears are devoid of hair, and are very large in proportion to the size of the head.

This is by no means one of the most plentiful of the monkey tribe, and, owing in part to its scarcity, and also to its quiet and retiring disposition, we know very little of its habits when in a state of freedom. It appears to be chiefly or entirely a vegetable feeder, fruits of various kinds seeming to form the major part of its diet.

THE pretty little Douroucouli (*Nyctipithecus trivirgatus*) is very seldom seen at large, its habits being almost entirely nocturnal. Indeed, its eyes are so sensitive as to be unable to endure the light of day, and not until darkness has fairly set in does the animal leave its place of repose in order to prosecute its search for food.

This food consists chiefly of small birds and insects of various kinds, in the capture of which it displays considerable address. It is even able to catch the night-flying insects when upon the wing, striking them down with a blow of its ready paw as they flit past its perch.

The douroucouli is remarkable for the small size of the ears, which indeed are quite invisible unless the fur be pushed aside. Owing to this peculiarity, the animal was formerly placed by itself in a distinct family, under the title of *Aotes, i.e.*, 'earless.'

The douroucouli is by no means uncommon in various parts of Brazil, but owing to its nocturnal habits is only very occasionally seen. It is not gregarious, like the generality of the monkey tribe, but appears to pass an almost solitary existence, contented with the society of the members of its own family.

There are several species of douroucouli, three of which, namely, the Three-banded Douroucouli, the Feline Douroucouli, and the Red-footed Douroucouli, have been kept in the Zoological Gardens within the last few years. No less than nineteen specimens of the Feline Douroucouli have been placed in the Gardens since 1857.

ONE of the prettiest and most graceful of all the monkey tribe is the common Marmoset (*Hapale jacchus*), a native of Guiana and Brazil. It is quite a small animal, its length being seldom more than seven or eight inches, exclusive of the tail, which measures about a foot.

The ground colour of the fur, which is singularly long and fine, is partly white and partly reddish-yellow, boldly variegated with streaks of blackish-brown. The tail is white, banded at short intervals with rings of a deep blackish hue. From either side of the head springs a tuft of radiating white hairs which impart a very singular appearance to the countenance.

Owing to its wonderfully gentle and docile nature, the marmoset is in great favour as a pet, and very shortly becomes perfectly domesticated, making itself fully as much at home in its new abode as does a favourite dog or cat.

The diet of the marmoset is of a very varied nature, and embraces both animal and vegetable substances. When in a wild state it appears to subsist chiefly upon insects, eggs, and fruits of various kinds, while it does not seem averse to a small bird when it is fortunate enough to capture one.

When domesticated, it generally turns its attention to the cockroaches, should the house be infested with these insects, eating the smaller ones entire, but carefully stripping off the heads, wings, and legs of the larger specimens before proceeding to devour them.

I once made friends with a beautiful little marmoset through the medium of flies. It was shy and retreated from me when I approached it. Presently, I saw it steal cautiously towards a fly that had settled near it and try to catch the insect.

So, I caught a fly, and held it up by the wings in front of the marmoset. The buzzing of the fly attracted it at once, and it came very slowly towards me. It then put out its paw timidly once or twice, making a little whimpering or twittering cry the while, and at last summoned up courage enough to take the fly.

It made but little difficulty in coming for a second fly, and soon was on the best of terms with me.

Within the last six years some twenty specimens of this marmoset have inhabited the Zoological Gardens.

A monkey very closely allied to the preceding animal is the Marikina (*Midas rosalia*), or Silky Marmoset, which is, perhaps, even more pretty and graceful an animal than even the marmoset. The fur, which is wonderfully soft and silky, is of a bright chestnut hue with a peculiar golden lustre, darkening slightly upon the paws and upon the upper portions of the limbs, but preserving a uniform tint upon the remaining parts of the body. The animal is termed the Silky Monkey on account of the silken texture of the long and glossy fur. Sometimes, also, it is known as the Lion Monkey, from the mass of long hair upon the head, which is thought to bear a resemblance to the mane of the lion.

The marikina seems to be fully aware of the beauty of its silky coat, and takes the greatest care to keep it free from the slightest speck of dirt. When kept in confinement, its surroundings must be kept scrupulously clean in order to preserve the health of the animal, which is sure to die before long if this precaution be not attended to.

In point of size, the marikina is as nearly as possible equal to the marmoset, the tail, also, bearing about the same proportion to the body as in that animal.

There is another darling little monkey that belongs to this group. It is popularly called the Pinche (a French word), and is scientifically named *Midas Œdipus*.

There is no difficulty in distinguishing this little creature on account of the long, white hairs that cover the head, and look very much like the full dress wig of our judges. The throat, chest, and abdomen are also white, and the rest of the body is greyish-black, except a patch of reddish fur on the shoulders.

Before taking leave of these monkeys, I must call attention to a statement of the late F. Buckland. He had much experience in monkeys and their ways, and was convinced that the monkeys of the New World were much superior in intellect and temper to their kinsfolk of the Old World. He strongly advises every one who wishes to keep a monkey to select one of the South American species, and to reject any that come either from Asia or Africa.

WE must now bid farewell to the monkeys of the American continent, and proceed to the curious group of *quadrumana* known, both popularly and scientifically, as LEMURS, all of which are natives of Madagascar and the neighbouring islands.

Few people, at first sight, would consider these animals to belong to the monkey tribe, their appearance and movements being far more quadrupedal than is the case with any of the *quadrumana* about which we have hitherto been reading. The aspect of the head, too, differs very considerably from the usual monkey type, the jaws and muzzle being narrowed and elongated in a manner which irresistibly reminds the observer of the common fox of our own country.

However, notwithstanding the points in which the lemurs differ from the remaining animals of the group, the structure of the paws at once points out their position in the animal world. Both the fore and hind paws are furnished with thumbs, which are opposable to the fingers, and can be employed with considerable dexterity in the manipulation of small objects.

All the monkeys of this group are remarkable for their stealthy and noiseless movements, and this peculiarity, together with their nocturnal habits, has earned for them the title of lemurs, which word signifies a night-wandering ghost.

The largest, and one of the most handsome of the group, is the Ruffed Lemur (*Lemur macaco*), an animal in which the contrast of colour is remarkably striking. The face, the fore parts of the body, the feet, the tail, and a patch upon the back, are of a jetty-black hue, while the remainder of the fur is of the purest white. A ruff-like fringe of long, white hairs surrounds the face, and has earned for the animal its popular title.

Although not a very uncommon animal, the ruffed lemur is far more often heard than seen, its hoarse, barking cry being audible for a considerable distance. It is fond of assembling in large flocks, the members of which lift up their voices in concert, producing sounds almost deafening in their intensity.

The character of this animal is very timid and retiring, and when attacked or pursued, it seems invariably to seek safety in flight whenever such a course is practicable. Should it be driven to bay, however, it will fight with great ferocity, using its sharp teeth with considerable effect.

A still prettier animal is the Ring-tailed Lemur, or Macaco (*Lemur catta*), which may be instantly recognised by the long and banded tail. It is not so large as the preceding animal, the head and body seldom exceeding a foot in total length, while the tail measures some seven or eight inches.

The fore arm and hand of this lemur are remarkable for a peculiar structure which causes the fingers to close mechanically when the limb is extended. The animal is thus enabled to suspend itself from a branch for a considerable time without fatiguing the muscles in any great degree.

The Diadem Lemur (*Propithecus diadema*) derives its name from the semi-lunar white stripe upon the forehead. Owing to one or two minor points of structure, this animal has been placed in a different genus from the preceding members of the group.

It is not a very brightly coloured animal, but may be easily distinguished from all it congeners by the white crescent-shaped mark upon the black face. The fore parts of the body are of a sooty black colour, which gradually fades into a pale brown upon the hinder quarters and the limbs. Beneath, the body is almost white.

Owing to their shy, nervous, retiring ways, the lemurs have been very happily called "the monkeys' poor relations."

Many examples of several species of lemurs have been kept in the Zoological Gardens. Generally they are asleep during the day, but they may be sometimes roused to action by the offer of a lively beetle or other insect. As they take it, the peculiar structure of the fingers may be noticed, each finger having a flat, soft pad at the tips, extending far beyond the nail. The lemurs are inquisitive creatures, and if a finger be put into their cage, they will take hold of it and examine as curiously as a money-changer scrutinizes a doubtful coin.

At dusk, however, the lemurs begin to wake up to their real day, and they traverse their cages with an activity that affords a curious contrast with their sluggish movements when the sun is above the horizon.

THE animals bearing the title of LORIS may be easily distinguished from the lemurs, which they otherwise closely resemble, by the entire absence of tail, the lack of which imparts to them a very singular appearance. The form of the head, too, is different, for, although the muzzle is as sharply pointed as in the lemurs, it becomes so very abruptly, and does not taper gradually from the ears to the nostrils, as is the case with the preceding animals.

The manner in which the blood-vessels of the limbs are modified in these animals is worthy of notice. The arteries, as they enter, and the veins, as they leave each limb, suddenly separate into a number of cylindrical vessels, which send off their branches in different directions. It is thought that this peculiar structure may be connected in some manner with the stealthy and silent movements which are so great a characteristic of the animals.

The Slender Loris (*Loris gracilis*) is a native of Ceylon, Java, Sumatra, and the neighbouring islands, where, however, owing to its small size and nocturnal habits, it is comparatively seldom seen.

Silent and stealthy as are the lemurs, the loris is so in an even greater degree. Sallying forth from its retreat after darkness has fairly set in, it is accustomed to prey upon various small birds as they roost among the branches, approaching them with a caution and address which never fail in securing the desired object. Moving by almost imperceptible degrees, the loris creeps up to its prey, and not until its fingers actually surround the unconscious victim is any intimation given of its approach.

This loris is quite a small creature, measuring only nine inches in length when fully adult. The limbs are very slender, and, indeed, the whole form is so slight and delicate as to have earned for the animal the specific name of '*gracilis*'—*i.e.*, graceful. The colour of the fur is grey, deepening slightly upon the face, and paling almost to white upon the lower parts of the body.

The Kukang, or Slow-paced Loris (*Nycticebus javanicus*), although similar in habits to the foregoing species, is yet very different from it in size and appearance. It is a decidedly larger animal, being upwards of a foot in total length. The colour of the fur is darker, and a deep chestnut-brown stripe surrounds the eyes and ears, running from thence along the entire length of the spine.

The kukang appears, when in a wild state, to subsist almost entirely upon small birds and insects of various kinds. In captivity, however, it becomes far less particular, and will feed both upon animal and vegetable substances, always, however, giving the preference to the former.

One of the smallest animals of the monkey tribe is the Little Galago (*Galago minor*) of Madagascar, which does not exceed in size an ordinary rat. Neither is its resemblance to that animal confined to size alone, for its whole appearance is so strongly suggestive of the little rodent with which most of us are only too well acquainted that it is often known as the Madagascar rat.

Like most of the animals of the group, it is nocturnal in its habits, seldom issuing forth from its concealment until the shades of night have fairly set in.

The little animal known as the Tarsier (*Tarsius spectrum*) is chiefly remarkable for the extraordinary length of the paws, which are longer in proportion to the size of the body than in any other member of the monkey tribe. This peculiarity is caused by the elongation of the tarsal bones of the hands and feet, whence the popular name of 'Tarsier' is derived. The animal is a native of various islands of the Malay Archipelago.

The tarsier is wonderfully active amongst the branches of its forest home, hopping from bough to bough in a manner which reminds the observer of the motions of a frog.

WE now come to an animal which has proved a terrible puzzle to zoologists, who were long uncertain as to its true position in the animal world. This is the Aye-aye (*Cheiromys Madagascariensis*), in which the characteristics of the *quadrumana* are strangely mingled with those of the *rodentia*. In the general form of the body, and in the structure of the paws, the aye-aye closely resembles the Galagos and the monkeys allied to them, while the formation of the teeth is almost exactly similar to that found in the rodent animals. Indeed, the only important difference seems to be that, whereas the incisor teeth of the rodents are furnished with a broad chisel-like edge, those of the aye-aye are sharply pointed.

In still another manner does the aye-aye differ from all the other members of the monkey tribe, for the mammæ of the female are placed upon the lower part of the abdomen, and not, as is generally the case, upon the breast.

On account of these teeth, Buffon placed it among the rodents. Cuvier, however, decided that it could not be a rodent on account of its paws, which resembled those of the monkey tribe, and accordingly placed it among the doubtful animals.

As to the front paws, there is a peculiarity in them, which is not to be found in any other animal. The third finger is much longer and more powerful than any of the others (the thumb being considered as the first), while the middle finger is so attenuated that it scarcely seems to belong to the same animal.

In 1859, Dr. Sandwith was fortunate enough to procure a living specimen, a male, in good health. The creature immediately began to gnaw its cage, and so Dr. Sandwith supplied it with tree branches. It so happened that some of these branches were tenanted by wood-boring grubs, and then the object of the peculiar teeth and finger was apparent.

The animal tapped the branches with the middle finger, and listened in order to detect the presence of a grub. It then rapidly gnawed away the wood, poked the long and slender finger into the hole, and hooked out the grub with its claw-like nail.

The aye-aye uses this slender finger in dressing its fur, keeping the other fingers closed.

Contrary to the usual rule, the fourth finger is the longest, and is employed by the aye-aye in drinking, the animal whipping the liquid into its mouth by quickly repeated strokes of the finger, just as a Chinaman can eat soup with his chopsticks.

The large bushy tail is useful to the aye-aye, and is used by way of bed-clothes, the animal curling itself up, and covering itself with the tail.

A fine female specimen was placed in the Zoological Gardens in 1862, and as she lived for some time, the habits of the creature could easily be studied. I saw her often, and wrote a tolerably full description of her in the *Boy's Own Magazine*, accompanied by an admirable portrait by the late Mr. T. W. Wood.

It is not often that a foreigner discovers an animal of which the natives are totally ignorant. But, when Sonnerat found the first specimen known to science, the natives were quite astonished, and cried out, 'Aye! Aye! Aye!' in token of surprise. Hence its popular name.

The aye-aye is a native of Madagascar, where, together with the lemurs and one or two allied animals, it seems to take the place of the usual quadrumanous forms. It is an exceedingly rare animal, and appears to be confined to the western portion of the island. Owing to its great scarcity and nocturnal habits, we know very little of its mode of life in a wild state, and have, indeed, much to learn with regard to all the members of the group to which it belongs.

THE extraordinary animal known as the Colugo, or Flying Lemur (*Galeopithecus volans*), evidently forms a connecting link between the monkeys and the bats, uniting in its own person the characteristics of the two groups.

The limbs and tail are connected with each other by means of a wide membrane, which, when extended, transforms the animal into a kind of living kite, enabling it to sweep through the air for very considerable distances merely by the impulse of the primary spring. According to Mr. A. W. Wallace, it seems to have some little power of directing its flight, for in his well-known work on the 'Malay Archipelago' he tells us—'Once, in a bright twilight, I saw one of these animals run up a trunk in a rather open place, and then glide obliquely through the air to another tree, on which it alighted near its base, and immediately began to ascend. I paced the distance from the one tree to the other, and found it to be seventy yards; and the amount of descent I estimated at not more than thirty-five or forty feet, or less than one in five. This I think proves that the animal must have some power of guiding itself through the air, otherwise in so long a distance it would have little chance of alighting exactly upon the trunk.'

While not in use, the membrane which connects the limbs and tail is wrapped so closely to the body as to be almost invisible, in order that the movements of the animal may in no way be incommoded. The upper surface is thickly clothed with hair, like the remainder of the body; the lower, however, is almost naked.

The mammæ of the female are four in number, instead of two, and are placed upon the lower part of the abdomen, just as is the case with the aye-aye.

The paws show very decided modifications from those of the preceding animals, for the thumbs are not opposable to the fingers, and the place of the nails is taken by sharp, hooked, and retractable claws.

The colugo is nocturnal in its habits, passing the hours of daylight suspended to some branch by means of its hinder limbs, much after the fashion of the bats which it so much resembles. It seems to feed upon both animal and vegetable substances, eggs, small birds, insects, and fruits of various kinds forming the major part of its diet.

The colugo is by no means a small animal, a full-grown specimen being about equal in size to a large cat. It is found in many of the islands of the Indian Archipelago.

(To be continued.)

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Eminent Practical Teachers.

PESTALOZZI.

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V.

THE teaching of Pestalozzi may be considered a new point of departure in the history of education, but from the very fact that modern elementary education has been so completely Pestalozzianized we are apt to forget how much it owes to Pestalozzi. His principles have, in the main, met with such universal acceptance, that they seem to be almost self evident, and to have come to us, as it were, by the light of nature. We are inclined to ask, Who that had turned his attention to the subject, could fail to see that education to be successful must begin with the first dawn of intelligence, must follow the natural order of the development of the faculties, must start from the point at which the child is standing, and advance outward in concentric circles, to embrace wider and wider fields of knowledge? Yet it cost Pestalozzi the unremunerated labour of fifty anxious years, and the sacrifice of all that makes life dear, to bring home these and a few more equally elementary truths to the intelligence of mankind.

Are we then to suppose that no one ever thought of these 'principles' before Pestalozzi first promulgated and exemplified them? The wise man has told us that 'there is nothing new under the sun,' and it is true that most of the constituent parts of his

system are to be found scattered up and down like broken lights in the earlier history of education, and his work consisted mainly in concentrating them into one focus. Thus Pestalozzi's fundamental principle, that the mother is the first and best of educators, and the home the first and best of schools, had been a leading feature in Roman education 2,000 years before. Luther, in the sixteenth century, and Comenius, the famous Moravian bishop, in the seventeenth, had taught that education should begin 'with the mother's school in every home.' Comenius again had anticipated Pestalozzi in enunciating the truth that education should follow the order and course of nature, and be so contrived as to take advantage of the fact that man has an innate tendency to improve the faculties with which he has been endowed. Again, the famous Jesuit teachers of the Renaissance anticipated Pestalozzi in seeing that a primary condition of success in education is to gain the confidence and attachment of the scholar, so as to be able, from thoroughly understanding his nature and character, to apply the guidance, incentive, or restraint, best suited to the wants of each. From the example of the Jansenists of the too short-lived Port Royal Schools, Pestalozzi might have borrowed another leading feature of his system, namely, to discard emulation, as an incentive to studious exertion, and to endeavour to supply its place by making the pupil find delight in the sense of his own accumulating knowledge and his own progress and growth in intellectual power. I use the expression 'might have borrowed' advisedly, for Pestalozzi apparently knew little, and cared less, for the previous history of educational experiments. It was one of the most unfortunate and fatal weaknesses of his position that he had early learned from his master, Rousseau, to 'hate and despise books,' and to recognise no merit or value in the exertions and the experiences of the great teachers who had preceded him. In what then does the importance and originality of his work consist? Chiefly in this, that having made out for himself a few leading principles which he believed to be true (and which turned out to *be* true in the main), he set himself to the task of promulgating them with such dogged perseverance, such intensity of conviction, and such entire self-devotedness, that he compelled the world to listen to him at last. It was to this, 'the divine faculty of taking pains,' which, according to the Germans, is the true definition of genius, that Pestalozzi owed his success as a practical teacher; for it must be confessed that there was hardly one of his own principles of education which he strictly adhered to in the actual conduct of his schools. In fact, he pathetically laments on more than one occasion the discrepancy between the beauty and truth of his principles and the imperfections of his practice. He was a poor unlearned man who had undertaken to grapple with some of the profoundest problems which have exercised the ingenuity of mankind, and though his insight was clear, he constantly felt the inadequateness of his practical powers to carry out his magnificent ideals. By way of illustrating the inconsistencies which appear in Pestalozzi's system, when fact comes into collision with theory, may be mentioned that while he justly regards the mother's instincts as the best guide to the treatment of the infant mind when it first begins to observe and inquire, he finds himself encountered by the difficulty that not one mother in ten is capable of the task of developing the perceptions of her child. He is compelled, therefore, to fall back upon Compendiums of Knowledge to be put into the mother's hands—compendiums, which he asserts will 'enable the mother of the most limited capacity to instruct just as well as the most talented. The mothers have only to keep strictly to these books in the instruction of their children.' These compendiums 'brought down some not unnatural, and perhaps not altogether undeserved, ridicule upon their author's head. As an example of the method of teaching 'Language'—'the mother's spelling book,' says he, 'must contain the entire range of sounds of which the language consists, and portions of it should be repeated daily in every family, not only by the child who is going through the exercises in order to learn how to spell, but also by mothers, within hearing of the child in the cradle, in order that these sounds may by frequent repetition be so deeply impressed upon the memory of the child, even while it is yet unable to pronounce a single one of them, that they may never be forgotten. No one imagines to what a degree the attention of infants is aroused by the repetition of such simple sounds as ba, ba, ba, da, da, da, ma, ma, ma, la, la, la, or what a charm such repetition has for them.' On this passage, one of Pestalozzi's biographers remarks, 'if the rocking songs sung to the babe in the cradle are to consist of such bleating as this, it is enough to frighten away its guardian angels.'

Again he constantly enlarges, and justly, on the mischief arising from mere word-knowledge in education, as opposed to that derived from perception and experience. 'In our lower school establishments,' he says, 'the mind is loaded with a burden of empty words which has not only effaced the impressions of nature, but has even destroyed the inward susceptibility to such impressions.'

But in the book for mothers, and indeed elsewhere, occur passages which seem to show that Pestalozzi attributed something little short of a magical power to words. The lessons are found to consist not even in the naming of objects, so much as in the acquisition of names, for their own sake. 'Lessons in nature consist in giving the children lists of the names of the most important objects in all three kingdoms of nature, etc. The lists of words are placed in the hands of the child merely as exercises in learning to read, and I have found that it is possible to make the children so thoroughly acquainted with these lists of words that they shall be able to repeat them from memory in the time that is required to perfect them in reading.'...As an example of a less objectionable but still quaint and roundabout method of teaching language through observation, the following passage is quoted from the experiences of Ramsauer, who has already been mentioned as a pupil of Pestalozzi. 'The hangings (in the castle of Burgdorf) were very old and torn, and before these we had frequently to stand for two or three hours together, and say what we noticed in respect of the form, number, position, and colour of the figures painted on them, and the holes torn in them, and to express what we observed, in sentences gradually increasing in length. On such occasions he would say, "Boys, what do you see?" (He never named the girls.) *Answer:* "A hole in the wainscot." *Pestalozzi:* "Now repeat after me:—I see a hole in the wainscot—I see a long hole in the wainscot—through the hole I see the wall—through the long narrow hole

I see the wall. I see figures on the paper-hangings—I see black figures on the paper-hangings—I see round black figures on the paper-hangings—I see a square yellow figure on the paper-hangings—and so on."' And this curious illustration of his practical subordination of observation and association to names and mechanical detail, is to be found in his method of teaching geography. He proceeds thus:—'One of the sub-divisions of Europe is Germany. The child is first of all made acquainted with the divisions of Germany into ten circles, then the names of the towns of Germany are placed before him, at first in mere alphabetical order for him to read, but each of these towns is previously marked with the number of the circle in which it lies. As soon as the child can read the names of the towns fluently he is taught the connection of the numbers with the sub-division of the main-heads, etc., etc.' In all this, be it observed, there is no hint of the use of a map.* But not to weary the reader with further details, it may be said that Pestalozzi has, as it were, set his own seal and signature to the indictment which experience has brought against his methods, in recording the following incident. M. Glayre, a member of the Executive Council of Bern, in hearing an explanation of his system, made the ominous remark, 'You want to make education mechanical.' 'He hit the nail on the head,' says Pestalozzi, and supplied me with the very expression that indicated the object of my endeavours, and the means which I employed for attaining it.' It must be borne in mind that Pestalozzi was a self-taught man, and all the blunders which occasionally deface his system were those of a self-taught man. It has been well said of him that 'he wanted the historical basis.' Methods which had been discovered long before, tried and found wanting, appeared to him as new revelations made to himself, and he had to learn their inefficiency by bitter personal experience—and at his pupils' cost. Everything had to be 'evolved,' like the well-known German camel, 'out of his own consciousness,' and he exhausted himself in inventing expedients which either were worthless when brought to a practical test, or had been invented and brought to perfection long before, if he had only known of them.

These inconsistencies have been dwelt on thus far, and at some length, partly because they seemed necessary elements in a true portraiture of Pestalozzi, and partly to account for the fact that many of his methods have been consigned to a not wholly unmerited oblivion, while his principles have exerted an ever-growing influence on popular education, stronger, perhaps, at the present time than when he was their living exponent, and at the zenith of his reputation. His principles are immutable, his methods experimental, and many of them, though condemned by himself on trial, have been blindly perpetuated by injudicious disciples, to the disadvantage of elementary education and the detriment of Pestalozzi's fame.

Of these methods, however, some few which contained a richer and more fruitful germ, have developed into a world-wide utility. Among these may be mentioned the plan of simultaneous syllabic reading—of mutual instruction—of teaching form and number by concrete examples, which forms the basis on which Fröbel built up his famous superstructure of the Kindergarten—and lastly, the introduction of object lessons, which now enter largely into the programme of every good infant school. Of these, the first two were almost forced upon him by the circumstances of his position. Of simultaneous reading Pestalozzi says, 'The confusion arising from a number of children repeating at once, after me (their sole teacher at Stanz), led me to see the necessity of a measured pace in reading and speaking, and this measured pace heightened the effect of the lesson.' It was at Stanz also that he first adopted the plan, afterwards so largely adopted by Bell and Lancaster, of setting children to teach children. But Pestalozzi's plan was very different from what was known in England as the 'Monitorial System,' by which 'one child was drilled through an artificial machinery of lifeless tasks, and the child so drilled employed for pay to drill others in the same manner and by the same means.' 'Seeing that I had no assistant teacher,' says Pestalozzi, 'I placed a child of superior capacity between two others. He threw his arms round their necks; he taught them all they knew; they learned from him what they knew not; they sat by the side of each other with heartfelt affection; joy and love animated their souls; the life which was awakened in them, and which had taken hold of their minds, carried both teacher and learners forward with a rapidity and cheerfulness which this process of mutual enlivening alone could produce.'

Pestalozzi was in the habit of dividing the elements of knowledge into three branches—Language, Form, and Number. It is hardly necessary to point out that these three categories do not embrace the whole field of knowledge in its most elementary aspect. There are numberless phenomena which present themselves to the observation of a child which have nothing to do with language, form, or number, but for practical purposes Pestalozzi tells us he found this classification work well. Of his lessons in Language we have already learned something in former pages, but it is only fair to state the theory on which he intended language should be taught, though we may not be disposed to imitate his practice. The first step, he tells us, is to teach the child to distinguish articulate sounds and imitate them. The second is to teach him to name everything brought under his notice, in order to furnish him with a supply of words. The third is to teach him to distinguish and name the most striking parts, characteristics, and qualities of particular objects—to observe them with intelligence, and then express himself correctly in describing them. The fourth is to teach him to abstract, generalize, and classify in language. The fifth, and last, is to teach him to describe not only the qualities of objects, but their uses, combinations, and relative values; and to assign them their several places in the social economy of the world. In this way the habit of viewing the material world with

* It is only fair to state here in Pestalozzi's own words the method of teaching geography, which he believed to be the right one, and which has now been, in its general outlines, adopted by most intelligent teachers:—

'The instruction in this subject begins with the observation of the district in which we live, as a type of what the surface of the earth presents. It is then separated into elementary instruction (*a*) including physical, mathematical, and political geography, and (*b*) the topographical part, in which each of the departments of the subject, suggested by the observation of the surrounding district, is prosecuted in a graduated course, and then reciprocal bearings brought out. By this foundation the pupils are prepared for forming a clear and comprehensive view of the earth and man, of their mutual influences, of the condition of states and peoples. The children are made acquainted with the statistical portion of the subject, that is, the natural productions numbers of population, forms of government, etc., by means of tabular views.'

intelligence is excited and cultivated, and this combined with the power of correct and ready expression. 'Language,' Pestalozzi observes, 'is the reflex of all the impressions which Nature's entire domain has made on the human race. Therefore I make use of it, and endeavour, by the guidance of its uttered sounds, to reproduce in the child the selfsame impressions which, in the human race, have occasioned and formed these sounds. Great is the gift of language! It gives to the child in one moment what Nature required thousands of years to give to man.' Compare these observations with the statement of Pestalozzi's opinions in p. 227, and mark how, in dealing with the relations of words and things, this profound but irresolute thinker fluctuated between the two great schools of thought which have divided the world since the days of Plato and Aristotle.

Secondly, with respect to Form. Pestalozzi invented a few of those simple mechanical appliances by which the eye and touch of babies are taught to distinguish between round and square, a process which we find thus magniloquently described: 'He learns the data of the science from the examination of geometrical solids.' Under the head of form he included writing, drawing, and geometry, holding that the basis of each of these requirements was the perception of shape and dimension. Drawing ought to be an universal accomplishment, because it leads the child from vague perceptions to clear ideas. The art of measuring must, however, precede that of drawing. 'If a child,' says he, 'is called upon to imitate objects before he has acquired a distinct notion of their proportions, his instructions in the art of drawing will fail to produce on his mental development the beneficial influence which alone makes it worth learning.' Then, again, writing, he contended, should be taught, not before, but after drawing, 'for writing is, in fact, a kind of lineal drawing, and that of fixed forms, from which no arbitrary or fanciful deviations are permissible.'* As to the method of imparting the last of the three Pestalozzian 'elements,' namely, Number, he thus writes himself: 'The rudiments of number should always be taught by submitting to the eye of the child certain objects representing the units. A child can conceive the idea of "two balls," "two roses," "two books," but it cannot conceive the idea of "two" in the abstract.' To this Dr. Mayo adds: 'When the child has been thus exercised in distinguishing and naming "one," "two," "three," the number of the different objects presented, he will soon have an intuitive perception that the terms "one," "two," "three" are always the same, while the objects, to which they are applied, vary; he will thus be prepared to separate the idea of number from that of the thing, and so ascend to the abstract idea. When he has a correct idea of the numbers up to ten, he is ready to carry on different combinations of these numbers. By practical examples, he learns to form rules for himself—he works his own way, acquiring power, vigour, and readiness at each advance; he is not led hoodwinked through the intricacies of arithmetic, but understands what he is about, first becoming acquainted with elements, and then enjoying the pleasure of finding the results of their various combinations. The whole is a reasonable exercise.' To conclude with a few words on the Pestalozzian method of teaching the elements of Latin, for which this seems to be the proper place. Dr. Mayo thus writes in one of the letters from which extracts were made in the last number: 'He does not begin with definitions, because children never comprehend them; but first, calling up the idea in the child's mind by conversing with him, he gives him the simple sentence "*leo est animal.*" Here the words *leo* and *animal*, being, one almost the same, the other quite the same as those which express the same ideas in English, they readily enter the child's mind. From this he proceeds to "*an ape is—what?*" "*an animal.*" "*Simia est—what?*" "*animal,*" the child using the word he had learned just before. Proceeding in this manner he stocks the child's mind with words, before he enters on the inflexions of those words, always endeavouring to link what the child has to learn with what he has already acquired. In the declensions he does not propose to the child "*musa*, a Muse, *musæ*, of a Muse"—words which cannot interest the child, because they represent only parts of ideas—but he involves the important word in sentences, thus: "*rosa est flos amænissimus horti,*" "*rosæ odor est suavis,*" etc., through all the cases The child having learned the inflexion of *rosa* has a similar word proposed to him, also enveloped in little sentences, but he is now required to find the termination. The advantages of this method are briefly these: you do not disgust the child with his first intellectual exertions, you exercise other faculties besides memory, you enrich his mind with a great number of ideas, and you furnish him with a *copia verborum* before you set him down to translate a classical author or to express his own ideas in a connected chain in the language.' He thus contrasts the above with the ordinary method of teaching language: 'In spite of every indication that the youthful mind spontaneously gives, that it is led from the perception of particulars to the conception of universal propositions—that it must first see embodied in realities and clothed with circumstances, the ideas which it is afterwards to recognise in their pure, abstract, intellectual form—the prevailing practice is forcibly to drive a child of tender years through the generalities of grammar, unintelligible and uninteresting to him, till at last in the course of their practical application, the true order of thought is established in his mind, and he understands and appreciates his grammar, through the knowledge which he derives from studying the language itself.'

The ideas thus enunciated were developed with well-known success in Dr. Mayo's own Pestalozzian school at Cheam. They lie at the bottom of the 'Hamiltonian' method, and of the 'Mastery System' of Mr. Prendergast, which is daily commending itself more and more to the minds of educationalists, as the true, rational, and scientific method; and, backed by his able and persevering advocacy, bids fair to revolutionize in the coming generation, the whole English system of teaching languages living and dead.

The foregoing is a very fragmentary and imperfect sketch of a subject on which volumes might be, and indeed have been, written—the *methods* of Pestalozzi. In the next and last article on his system, an attempt will be made to state and explain his *principles*.

(To be continued.)

* The principles of Pestalozzi's system of Geometrical instruction have been successfully and beautifully applied in 'The Lessons on Form' of Mr. Reiner, late of the Home and Colonial Training College.

'How I Teach Elementary Science.'

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

PUBLIC curiosity was greatly excited on the occasion of the removal from my workshop to the school of the apparatus here illustrated. Two solemn-looking boys carried the large frame, tied to a pole borne on their shoulders, while two others walked by their side with the ropes, pulleys, screw, etc., round their necks. I brought up the rear. We all preserved the utmost gravity, while the giddy crowd of onlookers indulged in frivolous remarks. 'It is part of a bedstead,' said one; a profane vulgarity that caused me at once to adopt the Polyphemic stride peculiar to an elementary teacher when in deep thought. 'A model of a sort of gallows for hanging Fenians,' said another; at which the small boy with the ropes about his neck looked all the innocent anguish of a man on his way to a cruel execution. When the little mournful procession arrived at the school the apparatus had to be deposited in one of the school lavatories, where it will remain when not in use, until the long-rumoured reduction of salaries takes place, when, of course, it will have to be sold, along with all the other accessories of science teaching that I have managed to get together.

Probably some of my fellow-teachers have, like myself, one of their rooms fitted up as a workshop; of course I mean at their own private homes, not at the school. Those that have not I should advise to set about getting it at once. Some hard work at carpentering and the lathe will help to throw off the old and worn-out material of both body and mind. To those who possess a workshop the construction of this apparatus is easy. The outer frame is about four and a half feet high, three feet wide, and is made of one-and-a half-inch-square pine, mortised at the corners, and let in at the bottom to a much stouter piece. To give it greater steadiness, iron brackets may be placed at the rear of the uprights at the base. The lever (Fig. 1) is of the same material as the sides of the frame, four and a half feet in length, of uniform thickness, and weighs exactly two pounds. It is marked off into equal distances, counting from each side of the centre C. When in use it rests upon the handle V (Fig. 2) as a fulcrum. The pulleys T and U are ordinary brass screw-pulleys: they can be bought at any ironmonger's. S, R, and Q are the same, but the threads of the screws are filed off, and the remaining short piece of iron heated and bent to form a hook. The cord from T to U passes through the frame for greater convenience in showing the running down of the weight P. Where the cord passes through the frame I have let in a small piece of brass-piping jointed into iron plates on either side. Below F are two of the commoner kinds of block pulleys. The sheaves (wheels) are brass, the frames iron, and other details steel. They are really beautiful pieces of engineering work, made by the father of one of the boys. It took him two weeks of evening work to complete them, and I could not prevail upon him to take a single halfpenny for his trouble. He is an engineer. If any teacher is not able to get this done so cheaply, he can easily make it himself if he has a 'slide-rest' to his lathe. At G is seen the wheel and axle. For the two-grooved wheel H get a piece of two-inch pine, cut it roughly round, and turn it up on the taper-screw chuck of the lathe. Let the larger wheel be eight inches in diameter, and the smaller one two inches. They are both in one piece, and are three-quarters of an inch thick. Turn the axle to one inch in diameter. For bearings, run on to each end of the axle a piece of brass piping half inch on the outside; fit into the frame pieces of iron piping half inch in the inside. One end of the axle runs through the centre of the wheel, into which it is fixed by a wooden peg through the smaller wheel. The whole should run easily. A pound weight, J, suspended by a cord passing round the large wheel, should exactly balance a weight, I, of eight pounds upon the axle. Fig. 3 is the inclined plane, removed, however, from its place on the apparatus in order to show the large screw W. When the plane is in use the screw W and the block X are removed; then the lower end, A5, of the plane is placed at Z, and the upper end, A4, rests upon the brass rod of which the handle is V. This brass rod may be inserted into any of the holes represented, and thus give various elevations to the plane. These holes, which are three inches apart from centre to centre, are drilled through iron plates screwed on to the uprights. The length of the plane is a little over three feet, and the height of the top hole one foot. The little carriage A6, which is to carry the weights to be drawn up the plane, weighs exactly one pound: it has four brass wheels upon steel axles. The wheels are grooved to run upon two lines of iron rails screwed down to the plane: by this means there is so little friction that one penny piece at the end of a cord passing over the pulley, just above A 4, is sufficient to draw along the truck when the plane is level. A weight of five pounds placed in the truck should exactly balance a weight of two pounds at A 3 when the plane is in position, elevated to the top hole at V. At W (Fig. 2) I have arranged the screw. All that can be shown here is the enormous power gained by the use of this simple machine. It is an ordinary wooden bench-screw, which, with its block, can be bought at any ironmonger's. The block X slides easily backwards and forwards upon a smooth table that also serves to connect the lower part of the frame. The plain part of the screw near its shoulders Y turns in a plain bored hole in the fixed block Z. In actual working the shoulder is of course close up against this block. Looped on to the movable block X are two stout cords: these unite, and pass over the pulley A 1. Upon turning the handle or lever of the screw at Y the weight A 2 is raised. A little child has by means of this screw easily lifted one hundredweight. The graduated rod or lever (Fig. 1) can also be used as a scale. If, for instance, it be placed against the upright on the right-hand side of the frame, it will mark the distance to which the weight P falls, and the height to which O is raised thus serving to illustrate that whatever gain there is in power is accompanied by a corresponding loss in distance.

The cost of materials for such an apparatus is about thirty shillings; but any school-furnishing firm would probably charge about five pounds for the complete machine.

I will now reproduce a lesson upon 'the Lever,' to illustrate the use of this contrivance.

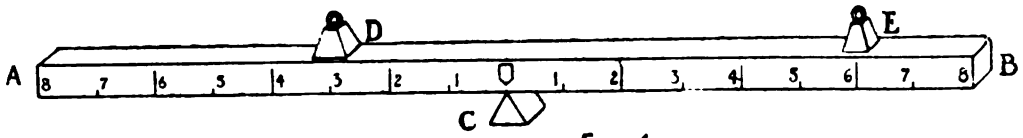


Fig. 1.

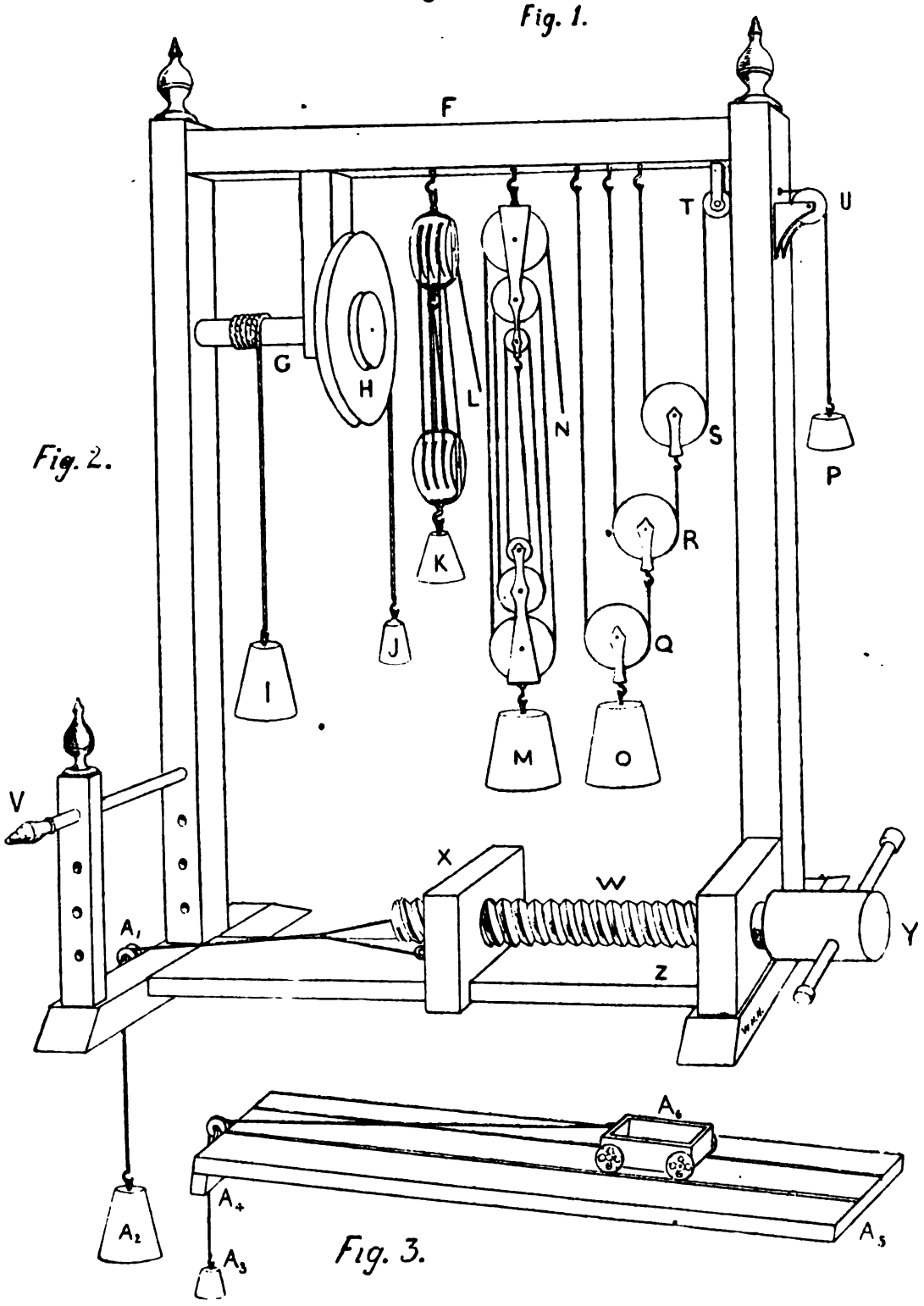


Fig. 2.

Fig. 3.

Jones, come out here, and try to lift that cupboard. You can't move it? Well, place the end of this rod a little way under it; now put this little block of wood under the rod close up to the cupboard; press down the other end of the rod; be careful. You see, boys, the cupboard is now being tilted up. Have you ever seen men lifting heavy things in that way? Ans.—Yes, sir: I saw a man getting up the flagstones in that way. (Another boy)—I saw a grocer getting a large barrel of sugar into his shop in that way. Just so. Embery, you seem stronger than Jones; come here; put the iron under the cupboard as before. Now I will bring the block a little farther out away from the cupboard. Now try to lift it. What! can't you move it? Ans.—No, sir; I can't shift it; there is not enough handle. What do you mean by 'not enough handle'? Ans. (Embery)—The distance from the block to my hand is not enough. Very well, then alter it. Ah! don't overturn the cupboard. You see how easily he tilts it. Try to lift the cupboard without the rod. You can't do it. You see, therefore, what an advantage there is in using this rod; and what must you do to lift the weight the more easily? Ans.—Have a long handle. Very good. Now you say that the distance from the block to your hand is the handle: what do you call the distance from the block to the other end of the rod? You don't know? You want a name for it; well, I will give you one, and also names for the other parts of this simple machine. Here is the picture of such a rod, with the names of the parts written. The rod itself is called a 'lever;' the block is the 'fulcrum;' the cupboard or whatever we want to lift we will call the 'weight;' the force you apply to lift it is the 'power;' the distance between the fulcrum and the power, which Embery called the handle, is the 'power-arm,' and that between the fulcrum and the weight is the 'weight-arm.' How much do you think that cupboard, with all the books and slates in it, weighs? Ans.—More than a hundredweight. Yes; I should think about two. Embery, do you think you could lift two hundredweight? Ans.—No, sir; not without that lever. (A boy)—He couldn't lift it *with* the lever at first. (Embery)—No, because there was not enough handle. (Teacher)—Don't say handle. (Embery)—The power-arm was not long enough. Just so. Do you think these boys pressed the lever downwards with a force of two hundredweight? Ans.—No, sir; much less. And can you tell me exactly how much less? Ans.—It depends upon how long the power-arm is. How do you know that? Ans.—From trying it, and from our common sense. Exactly so. Now we will carry our common sense a little farther, and after making a few experiments with this apparatus, find out the true or scientific relationship between the various parts of that mechanical power called the lever. Howell, you come here; place this lever on that fulcrum. (Fig. 1 is placed on V.) Balance it. You see the lever is marked so that you can easily find the centre. Do you know the name of that balancing point? (A boy)—The centre of gravity. (Another boy)—You said the centre of gravity was somewhere in the middle of the earth. Yes; so the centre of gravity of the earth is. (Another boy)—You said everything had a centre of gravity. And so it has. The centre of gravity of that lever is just about where Howell has balanced it. Now, Howell, put a four-pound weight on the lever, say three distances from the fulcrum. Hold up the lever. Smith, take this two-pound weight; put it on the other arm; see where it just balances. (Smith)—It balances now. How far is it from the fulcrum? Ans.—Six distances. Cox, come and write that on the black-board. 'Two pounds six distances from the fulcrum balances four pounds three distances.' Now take the weights off. Dedden, you come out; place this six-pound weight one distance from the fulcrum. Drayson, see where you have to put this two-pound weight in order to maintain equilibrium. Here it is, sir, three distances from the fulcrum. Very good. Cox, write that on the board. 'Six pounds one distance balances two pounds three distances.' Just so. Now all go to your places. Look, boys. I place eight pounds on the lever two distances from the fulcrum: tell me where I must put this two pounds in order to balance. Ans.—Eight distances. You are right. You see how exactly it balances. I will write that on the board. I want you all now to look upon the black-board. Think carefully of what we have done. Tell me whether, in these experiments, the results show a likeness in any respect. Ans.—Yes, sir: it's all the same thing. What do you mean, Richards, by 'all the same thing'? Ans. (Richards)—The arm that is shortest has the greatest weight. Very good. (Another boy)—The smallest weight is always on the longest arm. Yes; but that is almost the same as Richards has said. (Another boy)—If you call the arm on the left the weight-arm, and the one on the right the power-arm, then the weight is just as much greater than the power as the power-arm is greater than the weight-arm. (Howell)—If you multiply the weight by the weight-arm, it always equals the power multiplied by the power-arm. That's capital, Howell. Come out here, and show the boys that what you say is true. (Howell comes out greatly delighted.) In the first experiment four times three is the same as six times two; in the second, six times one equals twice three; in the third, eight times two equals twice eight. Very good. Now I want to write out these four quantities as a proportion: you can, I know, easily tell me how to do it, as you have lately heard a good deal about ratio and proportion. Ans. (Smith.)—The power is to the weight as the weight-arm is to the power-arm. Just so. I will write that on the board. 'P : W :: w.-a. : p.-a.'

In our next lesson we will work out some sums from this proportion. You may take out your exercise-books, and copy all that we have written on the black-board.

(To be continued.)

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.—*(dictated).*

(1) 846 + 35 + 978 + 867 + 429. Ans. 3155.
(2) From 810 take 26. Ans. 784.
(3) From 405 take 320. Ans. 85.

STANDARD II.—(*dictated: two sets*).

A (1) 67,894 × 85. Ans. 5,770,990.
(2) 40,016 ÷ 7. Ans. 5716 – 4.
(3) 41,302 – 34,067. Ans. 7235.
B (1) 67,894 × 94. Ans. 6,382,036.
(2) 40,016 ÷ 6. Ans. 6669 – 2.
(3) 41,302 – 40,819. Ans. 483.

STANDARD III.

(1) If 198 nuts be divided equally among 7 boys and 11 girls, how many will each receive? Ans. 11.

STANDARD IV.

(1) Multiply nineteen pounds thirteen and eightpence halfpenny by 109. Ans. £2145 14s. 2½d.
(2) If a man's wages are 3s. 7d. a day, and a boy's 1s. 3d. a day, how much will a farmer, who employs 8 men and 3 boys, pay per week of 6 days in wages? Ans. £9 14s. 6d.
(3) Divide £18,907 4s. 10d. (given in *words*) by 84. Ans. £225 1s. 8½d. – 64.
(4) In 763,972 inches (*words*), how many miles, fur., yds., etc.? Ans. 12 m. 0 f. 101 yd. 1 ft. 4 in.
(5) Subtract £12,907 17s. 6½d. from £22,382 7s. 10½d. (*words*). Ans. £9474 10s. 3¾d.

STANDARD V.

(1) If 147 yards cost £4 11s. 10½d., how many yards can be bought for 8s. 1½d.? Ans. 13.
(2) 8 yds. 18 ft. 216 in. at £1 16s. a *foot*. Ans. £421 8s. 6d.
(3) Make out this bill—3 lb. of tea at 2s. 9d., 14½ lb. of sugar at 7½d., and 2½ dozen eggs at 1s. 1½d. a dozen. Ans. £1 0s. 1½d.

STANDARD VI.

(1) If 32 men mow 360 acres in 8 days, in what time could 48 men mow 1080 acres? Ans. 16.
(2) Reduce 4s. 3½d. to the decimal of £1 5s. 9d. Ans. ·16.
(3) Find the value of $\frac{1}{2\frac{1}{5}}$ of $\frac{2}{3}$ of $\frac{1}{8}$ of a ton. Ans. 4 lb.
(4) If a wheel be 5½ feet in circumference, how many times will it revolve in 7·875 miles? Ans. 7560.

Domestic Economy.

STAGE III.

(1) How would you treat a burn?
(2) Why would you not look sad in a sick-room?
(3) How would you roast a piece of beef?
(4) How would you boil a piece of beef?
(5) Name one thing that is necessary in a sick-room.
(6) What would you do to ventilate a sick-room?
(7) How would you treat meat in making broth?

Geography.

STANDARD III.

(1) What is on the north of England?
(2) Name a river that flows into the Irish Sea.
(3) Mention a river that rises in Plinlimmon.
(4) What is on the E. of England?
(5) Another name for the same?
(6) What river rises in Wales and flows into the English Channel?
(7) Name an island south of England.
(8) In what river is it?
(9) Other islands in the English Channel?
(10) To which country are they the nearer?
(11) What is south of Wales?
(12) Through which English county does the Dee run?
(13) In what lake does it rise?
(14) Through which counties does the Wye run?
(15) Where is the Isle of Man?
(16) What separates Anglesea from the next county?
(17) What is the county on the other side of Menai Strait?
(18) Name the highest mountain in that county.
(19) What town stands on the Dee?
(20) Name seaports on or near the Bristol Channel.
(21) What strait joins the English Channel with the North Sea?
(22) Name a town on Cardigan Bay.
(23) On what river is Liverpool?
(24) Through what counties does the Thames flow?
(25) What is Anglesea besides an island?
(26) What country is on the other side of the English Channel?

STANDARDS IV. TO VI.

(1) What is another name for Tasmania?
(2) Name the parts of Australia.
(3) What are they called?
(4) What is the chief town in Victoria?
(5) What is the chief town in New South Wales?
(6) Chief river in Australia?
(7) Between what lakes are the Falls of Niagara?
(8) What is the largest river in North America?
(9) Name the strait between Tasmania and Australia.
(10) How many islands form New Zealand?
(11) Name a town in New Zealand.
(12) What do we get from there?
(13) Why do people go there?
(14) What is the distance of Australia from England?
(15) What was Australia formerly called?
(16) Name some of our possessions on the west of Africa.
(17) Why not emigrate to that part?
(18) Name an island in the Pacific Ocean belonging to England.
(19) What do we get from Australia?
(20) Where is Canada?
(21) How did we get it?
(22) When did we get it?
(23) Name the provinces in Canada.
(24) Name some towns in Canada.
(25) What is Nova Scotia?
(26) Where is it?
(27) Name a seaport of Nova Scotia.
(28) Name some lakes in Canada.
(29) What group of islands are east of Australia?
(30) How many islands form New Zealand? Name them.
(31) What do we get from Mauritius?
(32) Where is it?
(33) Name an island east of Africa belonging to England.
(34) Name an island in the Atlantic belonging to England.

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

No. XIII.—THE HOMOPTERA.

AS has already been mentioned in one of the earlier papers of this series, the *Homoptera* and the *Heteroptera* are often considered to form sub-orders only, being collectively known as *Hemiptera*. By those who follow this system they are respectively termed *Hemiptera-Homoptera*, and *Hemiptera-Heteroptera*. As, however, the distinguishing features of the two groups are very strongly marked, we will consider them as forming separate orders, to the first of which, the *Homoptera*, the present paper shall be devoted.

The *Homoptera* include a number of insects many of which appear to be totally dissimilar from one another, and it is not until we carefully examine the structural characteristics that we find them to possess any family resemblance. The distinguishing features of the order may be briefly summed up as follows.

In the first place, the structure of both the upper and the lower pairs of wings is of a similar nature, whence is derived the title of '*Homoptera*,' a word signifying 'same-winged,' and therefore very appropriate. These wings are membranous, the upper pair being slightly longer than the lower, which they entirely conceal when the insect is at rest. They do not overlap, however, the sutural margins running parallel with one another, just as is the case with the elytra of the *Coleoptera*.

The body is very convex, causing the wings to assume a rather curious position when not in use. This attitude is not easily described, but may easily be seen by an examination of one of the 'frog-hoppers' which are so plentiful in all parts of the country.

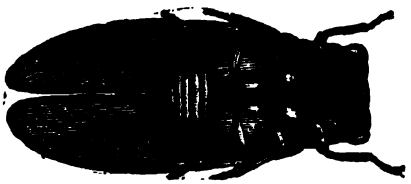
The mouth is situated on the lower surface of the head, and is furnished with a beak, or proboscis, by means of which the juices of the plants upon which the insect feeds can be imbibed into the system. This proboscis is merely a modification of the mandibles and the maxillæ, which are considerably elongated, and enclosed in the labrum, which forms a kind of sheath for the whole.

In all these insects the pupa is active, and generally bears a considerable resemblance to the perfect insect, the chief distinction, of course, lying in the absence of wings.

There is yet another characteristic of the insects of this order, however, and that a very important one, for upon it is based the present arrangement of the group. This is found in the structure of the tarsi, which, in the *Homoptera*, are never found to consist of more than three joints. They may, however, have less, and Mr. Westwood has divided the insects of the order into three groups, namely, those which possess three joints in the tarsi, those which have two joints, and those in which one joint only is to be found.

The first of these groups is scientifically known as the *Trimera*, and is sub-divided into three families, of two only of which we have representatives in this country. In all the insects of this group the antennæ are very short, and are terminated by a slight bristle.

Of the first family, the *Cicadidæ*, we have only one British representative, and that solitary exception is so rare that it is very seldom seen, even by working entomologists. This insect, the lower surface of which is represented in the accompanying woodcut, possesses no popular title, probably on account of its rarity, but is scientifically known as *Cicada anglica*.



Cicada anglica.

Many of the foreign cicadas, that is, as far as the males are concerned, possess the faculty of uttering a very loud and shrill cry, which is audible at a considerable distance. This sound is produced by a pair of tightly-stretched membranes found beneath the thorax, which are protected by a horny plate easily visible upon examination.

It has not as yet been ascertained whether our British *cicada* is musical or not, although the probabilities are that it is so. It is true that a specimen of the male insect was kept in captivity for a couple of days without being heard to utter a sound, but this period of time cannot be considered sufficiently long to warrant us in coming to any definite conclusion upon the subject. It is much to be hoped that the next person who is fortunate enough to meet with a male *cicada* will endeavour to set this mooted point at rest.

The female *cicada* is furnished with an ovipositor of rather curious form, resembling a double spear with strongly serrated edges. By means of this instrument the insect is enabled to bore a hole in the substances in which her eggs are to be deposited.

The larva dwells in burrows in the earth, which it excavates by means of the very powerful fore-limbs. These tunnels sometimes extend to a considerable depth, some of the foreign cicadas sinking their habitations more than three feet into the ground.

The representation of the cicada which accompanies this description shows very clearly the peculiar form of the head, which is common to all the insects of the family to which it belongs, and also illustrates the manner in which the proboscis is packed away beneath the body when not required for use. The form of the body, too, is very well depicted, and, were it not for the size, the woodcut would serve as a very efficient illustration of the lower surface of almost any of our British *Trimera*.

Of the second family of this group, namely, the *Fulgoridæ*, or Lantern-flies, we have no British examples, and, as our space will not allow us to describe any of the foreign *homoptera*, we must pass to the third and last family of the *trimera*, namely, the *Cercopidæ*.

These insects are more familiarly known by the title of 'Frog-hoppers,' as they are popularly termed when they have arrived at the perfect stage of their development, and by that of 'Cuckoo-spit,' by which they are generally known while yet in the larval condition.

There must be few, indeed, who have ever possessed the use of a garden, or enjoyed a country walk during

the summer months, who have not noticed the peculiar masses of frothy substance to be seen upon the stems of many plants, and which are frequently in such abundance as to completely drench the lower garments of the pedestrian.

This frothy secretion is popularly considered to be composed either of the saliva of the cuckoo or of that of the frog, to which notion are owing the popular titles both of the larva and the perfect insect. In reality, it is formed in a very singular manner.

Driving its beak into the skin of its food-plant, the grub extracts the juices which constitute its nourishment. When they have passed through the system, these juices are exuded in the form of the frothy substance with which we are so familiar, and which covers the entire body of the larva. At occasional intervals the bubbles of which this frothy mass consists resolve themselves again into a liquid form, a drop every now and then falling to the ground, while another slowly takes its place, following the first, after a time, in like manner.

In the insects of this group the hinder limbs are formed for leaping, and are endowed with truly wonderful powers. It has been calculated that by their aid one of these Hoppers can leap to a distance equal to seventy times its own length; much the same as if a man were to spring over four hundred feet of ground at a single bound.

In order that they may be enabled to obtain a firm purchase upon the ground while preparing for these wonderful leaps, the hinder tibiæ are armed with a number of sharp spines, which afford the requisite foothold.

None of the insects of this division possess the curious sound-producing apparatus found in the *cicadas*.

The most striking insect of this group is the Scarlet Hopper (*Cercopis sanguinolenta*), which may occasion-

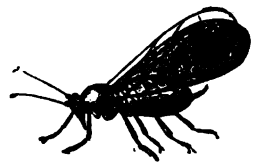
Scarlet Hopper (*Cercopis sanguinolenta*).

ally be seen resting on the leaves of the common bracken upon a sunny morning in the early summer. It is a remarkably handsome creature, which, once seen, can by no possibility be mistaken, the bold scarlet and black markings at once pointing it out from amongst its congeners.

This is by no means a rare insect, although it is very local, so much so, indeed, that it is often found to be confined to a few square yards of ground. Easily detected, on account of its brilliant colouring, it is by no means so readily captured, making one of its tremendous bounds at the slightest sign of approaching danger, and being quickly lost to sight among the herbage.

Many other frog-hoppers are known to inhabit this country, but they are, as a rule, so plain and insignificant to ordinary examination, and so similar to one another in their habits, that there is no necessity for us to expend space upon their description.

We will therefore pass to the next group of the *Homoptera*, namely, the *Dimera*, or those in which two joints only are found in the tarsi. This division includes the insects popularly known as Plant-lice, or Green Blight, and scientifically as *Aphidæ*, which are such terrible enemies to the horticulturist.



Aphis (*Winged form*).

These little insects are by no means formidable individually, but become so from the vast numbers in which they are found. They are wonderfully prolific, and that in a manner quite different from that which is customary with insects in general.

Aphis (*Apterous form*).

For, in these insects, the peculiar method of reproduction termed *Parthenogenesis* is strikingly exemplified. A female Aphis, kept entirely isolated from the other sex, will produce female young, and female young only, at the rate of fourteen or fifteen per diem, which, strange to say, pass through no preliminary stages of development, but are brought forth in a perfect condition, differing only in size from their parent. These in their turn give birth to a third generation, and so on. This strange method of reproduction has been known to extend over a space of several years, during the whole of which time no male aphis had been allowed access to the insects.

This will account for the wonderfully rapid rate at which the aphides increase, myriads appearing where only a few days previously not an example was to be seen. The birth of prolific females of course increases the reproductive powers to a wonderful extent, and there are few creatures which multiply with the extreme rapidity of the aphis.

Now and then the aphis does lay eggs, but this is the exception, and not the rule, the usual method of reproduction in this extraordinary insect being by the parthenogenesis above described.

Although individually an aphis can scarcely do any appreciable harm to a plant, the extraordinary numbers of the aphides render them a most terrible pest to agriculturists. There are few plants or trees to which some species of aphis does not attach itself, and which do not suffer very considerably from the ceaseless persecutions of its tiny foes.

The hop, especially, is a particular favourite with these little insects, and, were it not for the attacks of the ladybirds, the lacewing-fly, and many other insects which find in them their principal food, the cultivation of this plant would be an absolute impossibility. Gardeners, also, know only too well the ravages caused by the 'blight' upon many of their favourite flowers, and vainly exhaust their energies in devising means to extirpate their destructive foes.

Yet, by a marvellous provision of nature, the enemies of the blight seem always to appear in proportion to the numbers of the pest. If our walls and windows are overrun with ladybirds, we may be sure that the

blight has appeared in unusual numbers in the neighbourhood, and that its natural enemies have followed it in order to perform their appointed work of destruction. Sometimes, in the hop-grounds, these creatures may be seen literally in myriads, testifying by their numbers to the service they have rendered the agriculturist in destroying his terrible enemy.

The reader will remember that the frog-hoppers, which were described in the earlier portion of this article, exuded the vegetable juices which had passed through the system in the form of a mass of bubbles. The aphis behaves in a somewhat similar manner, ejecting the liquid through two minute tubes which project from the upper surface of the abdomen. The fluid, however, does not appear in the frothy form with which we are familiar in the case of the frog-hoppers, but is merely distilled into limpid drops of liquid, which successively fall upon the leaves on which the insect is resting.

This 'honeydew,' as it is termed from its sweetness, is a favourite beverage with ants, which, strange as it may appear, actually carry the aphides off to their nests, in order to procure an unfailing supply of the coveted dainty. Very often an ant may be seen upon the leaf of some plant or tree tapping an aphis gently with its antennæ, in order to induce the insect to exude a drop of the saccharine fluid, which is eagerly licked up as soon as it makes its appearance at the extremity of the abdominal tubes.

It is also said that the ants are in the habit of guarding their herds from the attacks of the hymenopterous parasites which are constantly seeking an opportunity of depositing their eggs in the bodies of their victims, and that they are always on the watch for the appearance of the winged parasite.

There are several kinds of aphis to be found in this country, but as all are very similar in habits it is needless to particularize any one species.

Closely allied to the preceding insects are those curious aphides which have received the generic title of *Eriosoma*, *i.e.*, 'wool-bodied,' for the reason that their bodies are covered with a substance resembling fine cotton wool. These creatures are popularly known as American Blight.

The woolly substance with which the bodies of these aphides is covered far exceeds in bulk the insects themselves, which it renders so light in proportion to their size that they are blown hither and thither by the least gust of wind. Should they once find their way to the branches of an apple-tree, the fate of that tree is sealed, unless immediate measures are taken for the extermination of the pest. Creeping into the crevices of the bark, the insects form a settlement, and quickly make their way over the entire tree, which speedily becomes overspread with the white cottony substance which covers the bodies of the aphides. Before very long, the tree fades, withers, and finally dies; why, no one can tell.

Mr. E. Newman tells us, in his well-known 'Letters of Rusticus,' that the only way of extirpating this destructive pest is by the free application of melted size to the affected trees, not even the smallest patch of the woolly substance being allowed to escape. This, he says, is far superior to the whitewash used in many orchards, which, besides being comparatively ineffectual, completely ruins the appearance of the trees.

In the winter-time the aphides retire to the earth at the foot of the tree in order to gain protection from the chilling cold. It is then advisable to turn over an inch or so of the soil upon every frosty day in order that the concealed insects may be killed by the exposure to the cold.

These aphides are not furnished with the abdominal tubes through which the honey-dew is distilled, that liquid being produced only by the insects of the preceding group.

The last of the three groups of the *Homoptera* consists of the *Monomera*, or those in which the tarsus is composed of a single joint only. These creatures, which are popularly known as Scale Insects, or Mealy Bugs, and scientifically as *Cocci*, are all included in a single genus.

These are in many ways most extraordinary insects, the females especially seeming actually to *deteriorate* as they approach the perfect condition. Indeed, when the final stage of their development is attained, the female *cocci* become, as Mr. Westward justly remarks, more like galls than living creatures, 'losing all trace of articulation in the body as well as of articulated limbs, and leaving inert and fixed masses of animal matter, motionless, and apparently senseless.'

During the earlier stages of their development the sexes are very similar in appearance, both being very active at this period of their existence. After some little time they insert their beaks into the bark of some twig, or the veining of a leaf, and remain motionless, increasing, meanwhile, very rapidly in size. In this position they pass the winter, at the end of which the males take to themselves wings, and fly away in search of their mates, while the females remain fixed as before.

The male *coccus* presents a very different appearance from his obese and unwieldy mate, being really quite a handsome insect. The body is of a deep red colour, while the two wings are of an opaque white, edged with a band of deep crimson. He is very much smaller than the female, and, indeed, presents so totally different an appearance that the two would never be taken for the same species.

The eggs deposited by the female are about two thousand in number, and are enveloped in a kind of woolly substance which entirely conceals them from view. As soon as they are laid the parent insect dies, her body flattens and becomes shrivelled and hard, and forms a kind of covering for the eggs, which are situated beneath it.

The British *cocci* are terrible nuisances to the gardener, more especially in hot-houses, where they wreak considerable havoc among the flowers. Some of the foreign species, however, are directly useful to mankind, the well-known Cochineal Insect (*Coccus cacti*) being one of these. From another species, the Lac Insect (*C. lacca*) we obtain our sealing-wax, and a peculiar kind of wax from a third, *C. ceriferus*. The British species, however, have as yet been brought to no practical use.

(To be continued.)

—o—

THE SQUIRREL.

Music by T. CRAMPTON.

Lively. mf

1st TREBLE.
2nd TREBLE.

1. You can't catch me! I live in a tree, High up a-bove the ground; I
2. My food, so good, I find in the wood: A-corns and nuts, all these, I
3. Who'll live with me, So jol-ly and free, And sleep in my lit-tle nest? "Oh,

BASS.

KEY G. *Lively. mf* D. t.

1st TREBLE. | m | s m :d m | r d .t, ,l, :s, .s, | d f .s ,l :s .t | d' : .s
2nd TREBLE. | d | m d :d d | l, .f, ,f, :s, .s, | s, d .m ,f :s .f | m : .m
BASS. | d | d d :m d | f, .r, ,r, :m, .m, | m, l, .d ,f :m .r | d : .ta,

take my rest In a lit-tle nest, So snug, and safe, and sound. I'm
tru-ly tell, I like twice as well As pie or bread and cheese. I
no!" you say, "Lit-tle squir-rel, good-day! I like my home the best." Ha!

f. G.

| d' .l :f .l .l | s ,f .m ,r :d .s | l .r' :s .t | d' : . | .d' s
| f .f :f .f .f | m ,r .d ,t :d .m | f .f :f .f | m : . | .f d
| l, .d :l, .f, ,f, | s, ,s, .s, :d .d | f .r :t, .s, | d : . | .l, m,

fond of fun— I romp and run A-bout from tree to tree; When
hide my food A-bout the wood, In a-ny hole or nook; When
ha! ha! ha! You'd want your mamma, If you did live with me: 'Tis

| l .f :r .m ,f | s .m ,m :d .r ,m | f .r :m .d | s .- : .m ,f
| d .l, :l, .d | d .d ,d :d .t, ,d | r .t, :d .d | t, .- : .d ,r
| f, .f, :f, .f, | m, .m, ,m, :m, .s, | r, .s, :d .l, | s, .- : .d

Symph.

you pass by, I'm up so high That none of you can see.
trees are bare, I know 'tis there, And have not far to look.
bet-ter by far to stay where you are, And leave me in the tree.

Symph.

| s ,s m :l .f | s .m ,m :s .m | r .m ,f :m .r | d :-. | .d' ,t | l,s .f,m :r .s | d :-.
| m ,m d :f .r | m .d ,d :m .d | l, .l, :s, .f, | m, :-. | . | d :- .t, | m, :-.
| d ,d .d :d .d | d .d ,d :d .d | f, .r, :s, .s, | d :-. | .m, | f, .l, :f, .s, | d, :-.

ANSWERS TO

Pupil Teachers' Examination Paper.

MAY 27TH, 1882.

CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. What sum of money will be required to pay the wages of thirty-one joiners for thirty-one weeks, at £1 9s. 11½d. per week?

31 joiners × 31 = 961 joiners for 1 week at £1 9s. 11½d.

	£	s.	d.
Cost of 961 at £1 each ... =	961	0	0
,, ,, 10s. ,, ... =	480	10	0
,, ,, £1 10s. each ... =	1441	10	0
Deduct ,, ,, ¾d. ,, ... =	3	0	0¾
	1438	9	11¼ Ans.

2. What should be gained from the produce of 673 cows, reckoning the produce of eleven cows at £122 7s. 0½d.?

Produce of 1 cow = £122 7s. 0½d. / 11 = £11 2s. 5½d.

	£	s.	d.
Produce of 673 cows at £1 each ... =	673	0	0
			11
,, ,, ,, £11 ,, ... =	7403	0	0
,, ,, ,, 2s. 6d. = ⅛ val. at £1 =	85	7	6
,, ,, ,, £1 2s. 6d. .. =	7488	7	6
Deduct ,, ,, ,, ½d. ... ... =	1	8	0½
∴ Total profit ... ... =	7487	19	5½

3. A clothier purchases 46 yds. 3 qrs. 3 nails of Tweed at 3s. 4d. a yard, and pays the bill with a £10 bank note; what change ought he to receive?

	£	s.	d.
Value of 46 yds. at 3s. 4d. each =	7	13	4
∴ ,, 3 qrs. = ¾ of value of 1 yard =	0	2	6
,, 3 nls. = ⅜ ,, 3 qrs. =	0	1	10½
	7	17	8½

∴ £10 − £7 17s. 8½d. = £2 2s. 3½d. Ans.

4. What should be the weekly gain from the produce of 673 cows, if the produce of one hundred and one cows be valued at £1,123 8s. 3½d. per year?

101 cows : 673 :: £1123 8s. 3½d. : ?

£1123 8s. 3½d. × 673 / 101 = £11 2s. 5½d. × 673 =

£7487 19s. 5½d. Ans.

5. In a certain parish a poor rate of 5d. in the pound yields the sum of £123 6s. 8d. If a second parish, with a rental equal to as much and a half again as the first, be added to it, how much will the rate on the united parishes require to be increased in order to produce £339 3s. 4d.?

Rental of first parish = £123 6s. 8d. / 5d. = 20 4/12 0 = £5920

,, second ,, = £5920 × 1½ = 8880

,, united parishes ... ... = £14800

∴ New rate per £ = £339 3s. 4d. / 14800 = 3/14800 d. = 5½d.

∴ The rate on the united parishes must be increased ½d. Ans.

FEMALES.

1. Find the cost of eleven thousand two hundred and ninety-two articles at £56 3s. 10½d. each.

	£	s.	d.
Value of whole at £1 ... ... =	11292	0	0
			56
,, ,, £56 ... ... =	632352	0	0
,, ,, 2s. 6d. = ⅛ val. at £1 =	1411	10	0
1s. 3d. = ½ ,, 2s. 6d. =	705	15	0
1½ = 1/16 ,, 1s. 3d. =	70	11	6
Total value ... ... =	634539	16	6 Ans.

2. What is the value of 53 tons 9 cwt. 2 qrs. 21 lbs. at £19 3s. 6d. per cwt.?

	£	s.	d.
Value of 1 cwt. ... ... =	19	3	6
			1069
,, 53 tons 9 cwt. ... =	20325	0	0
,, 2 qrs. = ½ value of 1 cwt. =	9	11	9
,, 14 lbs. = ½ ,, 2 qrs. =	2	7	11½
,, 7 lbs. = ½ ,, 14 lbs. =	1	3	11½
Value of whole ... =	20511	5	1½ Ans.

3. What would be the cost of making a railroad 1772 miles 5 fur. 12 poles in length at £1159 10s. per mile?

	£	s.	d.
Cost of making 1 mile ... ... =	1159	10	0
			1772
,, ,, 1772 mls. ... ... =	2054634	15	0
,, ,, 4 fur. = ½ cost making 1 ml. =	579	15	0
,, ,, 1 fur. = ¼ ,, 4 fur. =	144	18	9
,, ,, 10 p. = ½ ,, 1 fur. =	36	4	8½
,, ,, 2 p. = ⅕ ,, 10 p. =	7	4	11½
Cost of making whole ... =	2055402	3	4½ Ans.

4. Make out the following bill:—

441 pairs of blankets at 19s. 9d. per pair.
1953 yards of muslin at 1s. 6½d. per yard.
819 pairs of stockings at 1s. 9d. per pair.
2079 yards of calico at 10d. per yard.
1134 pairs of gloves at 3s. 3d. per pair.

	£	s.	d.
441 prs. at 19s. 9d. per pair ... =	435	9	9
1953 yds. at 1s. 6½d. ,, yd. ... =	150	10	10½
819 prs. at 1s. 9d. ,, pr. ... =	71	13	3
2079 yds. at 10d. per yd. ... ... =	86	12	6
1134 prs. at 3s. 3d. per pr. ... ... =	184	5	6
Amount of bill ... ... =	928	11	10½ Ans.

Grammar.

1. Parse all the verbs in the following:—

'Then come, my sister! come, I pray,
With speed put on your woodland dress;
And bring no book: for this one day
We'll give to idleness.' WORDSWORTH.

Point out the adjectives in the above, and state to what class of adjectives each belongs.

VERBS.

Come—intrans., irreg., *come, came, come*, imper., 2nd pers., sing., agr. with (*thou*).
come—same as above, intensifying the first 'come.'
pray—trans., reg., indic., pres., 1st pers. sing., agr. with *I* and gov. (*thee*).
put—trans. irreg. *put, put, put*, imper., 2nd pers. sing., agr. with (*thou*).
bring—trans. irreg. *bring, brought, brought*, imper., 2nd pers. sing., agr. with (*thou*).
will—irreg. defec. *will, would*, indic., pres., 1st pers. plur., agr. with *we*.
give—trans. verb, irreg. *give, gave, given*, infin. pres. gov. by *will*.

ADJECTIVES.

my—pronominal possessive adjective.
your— ,, ,,
woodland—distinguishing ,,
this— ,, ,,
one—numeral ,,
no—negative ,,

2. What is meant by the comparison of adjectives? Give examples of adjectives that do not admit of comparison.

By the comparison of adjectives is meant such an inflection of the adjective as increases or lessens the signification. There are three degrees of comparison—positive, comparative, and superlative. Of course those adjectives whose meaning can neither be increased nor diminished do not admit of comparison, as:—*extreme, perfect, entire, square. infinite, universal;* and all *numerals*.

3. In what ways is the gender of nouns distinguished? Give examples.

The gender of nouns is distinguished (1) *by different words*, as:—*king, queen; horse, mare; duck, drake.* (2) *by a different termination of the same word*, as:—*actor, actress; hero, heroine; peer, peeress.* (3) *By a word prefixed*, as:—*he-goat, she-goat; man-servant, maid-servant; male-child, female-child.*

Geography.

1. Name in order the river-mouths, bays, headlands, and principal seaports between Land's End and the North Foreland.

Beginning at Land's End we go eastwards passing Mount's Bay, Lizard Point, Falmouth and Harbour, Mouth of Tamar, Plymouth and Devonport on Plymouth Sound, Start Point, Dartmouth, Tor Bay, Mouth of Exe, Mouth of Axe, Portland Bill, Weymouth and Harbour, St. Alban's Head, Mouth of Avon, Poole Bay, Needles, Solent, Mouth of Test, Southampton, Portsmouth and Harbour, Selsea Bill, Mouth of Arun, Mouth of Ouse, Beachy Head, Mouth of Rother, Dungeness, Dover, S. Foreland, Deal, The Downs, Mouth of Stour, Ramsgate, N. Foreland.

2. Describe as fully as you can the position, appearance, climate, and productions of the Channel Islands.

The Channel Islands (Jersey, Guernsey, Alderney, and Sark) lie in the English Channel adjacent to the shores of France, and are officially included in the county of Hampshire. They consist almost entirely of granite rock, and sienite is quarried in Jersey and exported as granite.

The climate is mild, but moist, owing to frequent rains and the prevalence of sea-fogs.

Jersey and Guernsey produce fruits and vegetables in abundance, apples are largely grown and great quantities of cider are made. Potatoes are raised in large quantities, and both Jersey and Alderney are celebrated for a small kind of cow (called the Alderney cow). Jersey exports a considerable quantity of butter and other dairy produce.

The fisheries of Jersey are valuable, and embrace the lobster, oyster, and cod, all of which are exported.

Ship-building is carried on to a considerable extent in the same island. Jersey is hilly and well watered; Guernsey level in the north, but hilly in the south, also well watered; but less generally fertile than Jersey.

3. Describe fully the courses of the Clyde, the Shannon, and the Dee.

If you know of two rivers bearing one of these names describe both.

If you can, draw a map to illustrate *one* answer, and insert the lines of latitude and longitude.

The *Clyde*, ninety-eight miles long, has its source 1400 feet above the sea in the central highlands of southern Scotland, and the upper part of its course is closely adjacent to some of the smaller tributaries of the Tweed basin. It flows north-west through Lanarkshire, and near the county-town forms three considerable falls, by which it descends 230 feet within a distance of four miles. It is navigable below Glasgow, which is the limit of tide-water. The principal tributaries are the *Douglas* and the *Avon* on the left, and the *Calder* and *Kelvin* on the right bank.

The Shannon from Lough Allen flows S. and W., having on its right bank, Roscommon, Galway, and Clare; on its left bank, Leitrim, Longford, West Meath, King's County, Tipperary, Limerick, and Kerry, and falls into the Atlantic sixty miles below Limerick. It passes through L. Ree, and L. Derg, and receives the *Suck* which separates Roscommon from Galway.

The *Dee* in Aberdeenshire is eighty-seven miles long, and has its source in the Cairngorm group of mountains, at a height of 4060 feet above the sea—a greater elevation than that of any other river in the British Islands. The bed of the river has on that account a very considerable declivity, and its course eastward to the German Ocean is exceedingly rapid.

The *Dee*, in Kircudbrightshire, forty-five miles long, forms in its middle portion a long narrow lake called Loch Ken, ten miles in length, by from one-half to three-quarters of a mile in breadth, and falls into the Solway Firth.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

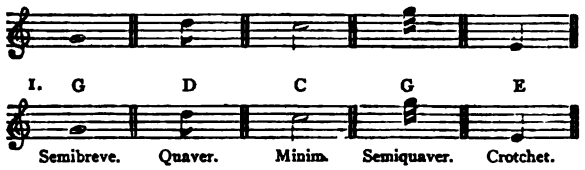
Write in large hand, as a specimen of copy-setting, the word *Pathetic.*

Write in small hand, as a specimen of copy-setting, *Englishmen know little of the French navy.*

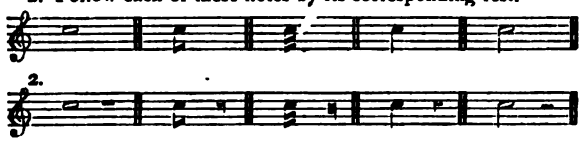
Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (C, D, *Do Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.



3. Supposing we make two beats while we sing a minim, how many shall we make while we sing a semibreve?

3. If we make *two* beats while we sing a minim, we shall make *four* while we sing a semibreve, because a semibreve is equal in duration to two minims.

FIRST YEAR.

Pupil Teachers at end of First Year.

Arithmetic.

Three hours and a half allowed.

MALES.

1. A penny is ·08975 inch thick; find the height of a pile of 1,000 pennies.

·08975 in. × 1000 = 89¾ in. = 7 ft. 5¾ in. Ans.

2. What decimal of 5 tons is 4 cwts. 3 qrs. 6 lbs.?

$$\frac{\text{4 cwt. 3 qrs. 6 lbs.}}{\text{5 tons}} = \frac{538}{11200}\text{ lbs.} = \frac{5\cdot38}{112} = \frac{\cdot33625}{7}$$

$$= \cdot0480\dot{3}5\dot{7}1\dot{4}2\dot{8}. \quad \text{Ans.}$$

3. Given 15s. 6¾d. as the price of 1¾ cwt., find the cost of 4 1/16 cwt.

1¾ cwt. : 4 1/16 :: 15s. 6¾d. : ?

$$\frac{560\text{d.} \times 79 \times 4}{3 \times 16 \times 7} = \frac{1580}{3}\text{d.} = £2\ 3\text{s.}\ 10\tfrac{3}{4}\text{d.} \quad \text{Ans.}$$

4. I am owed a sum of £50 by each of two bankrupts, A and B, one of whom (A) can pay ⅘ of ⅞ of his debt, and the other (B) 10s. 4d. in the £. How much more should I get from one than from the other?

A can pay ⅘ of ⅞ or 7/10 of his debt = 7/10

B ,, 10/240 or 1/20 = 7/140

∴ B pays 1/140 more than A

i.e. 1/140 of £50 = 10/140 s. = 2s. 4¼d. Ans.

5. What fraction of the area of the floor of a room 30 feet square would be left uncovered by 133 yards of carpet ¾ of a yard wide?

30 ft. × 30 ft. = 900 sq. ft. = area of room.

133 yds. × ¾ × 9 = 2691/4 sq. ft. = ,, carpet.

3600/4 sq. ft. − 2691/4 sq. ft. − ¾ sq. ft. uncovered

i.e. 9/1600 = 1/175 of the whole. Ans.

FEMALES.

1. If an income of £149 10s. is taxed at the rate of 5 pence in the pound, how much clear income will remain after the tax is paid?

Since 235d. is clear income out of £1, or 240d.,
then 240d. : 235d. :: £149½ : ?
$£\frac{299}{2} \times \frac{235}{240} = £\frac{14095}{96} = £146\ 7s.\ 8\frac{1}{2}d.$ Ans.

2. The carriage of 89 tons 15 cwt. for 120 miles cost £4 9s. 9d.; what will be the carriage of 29 tons 15 cwt. for the same distance?

1795 cwt. : 595 cwt. :: £4 9s. 9d. : ?
$\frac{1077d. \times 595}{1795} = 357d. = £1\ 9s.\ 9d.$ Ans.

3. If 35 bales of cotton, each weighing 120 lbs., cost 100 guineas, what will 20 bales of an inferior quality cost, each weighing 130 lbs., supposing 8 lbs. of the former to be worth 12 lbs. of the latter?

35 bales : 20 bales
120 lbs. : 130 lbs.
12 : 8
:: £105 : ?

$\frac{£105 \times 20 \times 130 \times 8}{35 \times 120 \times 12} = £\frac{140}{3} = £43\ 6s.\ 8d.$ Ans.

4. If 5 needlewomen make 6 shirts in 4 days of 12 hours each, how long will it take 4 needlewomen to make 17 shirts, working 8½ hours per day?

4 women : 5 women
6 shirts : 17 shirts
8½ hours : 12 hours
:: 4 days : ?

$\frac{4 \text{ days} \times 5 \times 17 \times 12}{4 \times 6 \times 8\frac{1}{2}} = 20$ days. Ans.

Grammar.

1. 'Alas! too soon that pride was o'er,
Sunk with the lay that bade it soar.
His soul resumed, with habit's chain,
Its vices wild and follies vain.'—SCOTT.

(*a*) Parse all the pronouns in the above.
(*b*) How can you tell when the word '*that*' is a pronoun and when it is a conjunction?

(*a*) *that*—simple rel. pron., referring to 'lay,' 3rd pers., sing., neut., nom. to *bade*.
it—pers. pron., standing for 'pride,' 3rd pers., sing., neut., obj. gov. by *bade*.
(*b*) '*That*' is a pronoun when who, whom, or which can be substituted for it, as, *the lay that* (*which*) *bade it soar*.
'*That*' is a conjunction when it indicates a *cause*, a consequence or final end, as, *He works hard that he may gain the prize*.

2. Distinguish between possessive adjectives and possessive pronouns. Give examples of each.

Possessive adjectives (my, thy, his, her, its, our, your, their, own) are used with nouns only, as, *my* book, *his* hat.
Possessive pronouns (mine, thine, his, hers, its, ours, yours, theirs) are used when the noun to which they relate is not expressed, as, this book is *mine*, this pen is *yours*.

3. Some adverbs are formed from nouns, some from adjectives, some from pronouns. Give a few examples of each.

Adverbs are formed:—
From nouns—*needs*, *straightways*, *noways*, *whilom*, *meantime*.
From adjectives—*twice*, *unawares*, *formerly*, *much*, *little*.
From pronouns—*here*, *hither*, *where*, *why*, *whence*, *thence*, *the*, *there*.

Geography.

1. Draw a full map of Russia in Europe, and insert the lines of latitude and longitude.

2. Trace minutely the courses of the Elbe, the Oder, and the Vistula, mentioning in order, the tributaries and towns connected with each of them, and describing the character of the country hrough which they flow.

The *Elbe* rises in the Riesen-gebirge, at an elevation of 4,400 feet, flows south through a wild narrow valley, bends north-west, and is joined by the Moldau. Flowing north, it is joined by the Eger, enters Saxony, and is joined successively by the *Mulde*, *Saale*, *Havel*, and *Spree*. Between Hamburg and Harburg, the river is divided into several arms, enclosing some large islands, but these arms soon afterwards unite, and the Elbe enters the Atlantic in one stream; its total length being about 600 miles.

The basin of the Elbe is at first an elevated plateau formed by the mountains of Bohemia, possessing vast forests and rich mines. In Saxony, the district is hilly, rich in minerals, and has beautiful scenery and a fertile soil.

The towns on the Elbe basin are Budweis, Prague, Carlsbad, Dresden, Wittenburg, Chemnitz, Jena, Leipzig, Halle, Magdeburg, Berlin, Hamburg, Altona, and Cuxhaven.

The *Oder* rises in Moldavia, at an elevation of about 1,800 feet, runs north-east until it leaves Austria, when it turns north-west. It continues in this direction with a very winding course, until it is joined by the *Lower Neisse*, then flowing northwards it is increased by the waters of the *Wartha*, and falls into the Great Haff. The Wartha, which is its most important tributary, is augmented by the *Netze*.

The Oder drains Pomerania, Posen, and Silesia. Pomerania is for the most part a sandy plain, covered with heaths and forests. Agriculture is in a backward state. Posen is naturally more fertile, but agriculture is not more advanced than that of Pomerania. Silesia rears a great number of sheep, and is exceedingly rich in minerals, especially in the mountainous districts of the south-east.

The towns in its basin are Oppeln, Glatz, Neisse, Breslau, Liegnitz, Frankfort, Posen, Stettin, Swinemund.

The *Vistula* rises in the Carpathian mountains, flows first north then north-east, till it is joined by the *San*; it then turns northwards and is joined by the *Bug*. Now bending to the north-west it continues in that direction to Thorn, when turning again to the north, it falls into the Baltic. The Vistula flows through a district forming a part of the great European plain. The country is flat, and hence the river is navigable throughout the greater part of its course. The river discharges its waters by three mouths, two of which open into the Frische Haff, but the main stream flows into the Gulf of Dantzic.

The towns in the basin of the Vistula are Cracow, Warsaw, Thorn, Bromberg, Graudenz, Marienburg, Elbing, Dantzic.

History.

1. When did Edward the Martyr, Harold II., and William and Mary ascend the throne?

		A.D.
Edward the Martyr ascended the throne		975
Harold II.	,,	1066
William and Mary	,,	1689

2. Who were the immediate successors of Richard III., Edward VI., George II., and William IV.? Give dates.

				A.D.
The immediate successor of Richard III. was		Henry VII.	...	1485
,,	,,	Edward VI.	,, Mary ...	1553
,,	,,	George II.	,, George III. ...	1760
,,	,,	William IV.	,, Victoria ...	1837

3. How many kings named Edward, reigned between the Norman Conquest and the fifteenth century? Tell their dates of accession.

		A.D.
Edward I.	ascended the throne	1297
Edward II.	,, ,,	1307
Edward III.	,, ,,	1327

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Pathetic*.
Write, in small hand, as a specimen of copy-setting, *Englishmen know little of the French navy*.

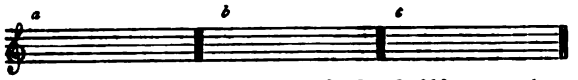
Music.

A quarter of an hour allowed for this Paper.

1. What is meant by *sound*, what by *tone*; and how does a sound differ from a tone?

1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular, the result is a *musical* sound.
A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) *Do*, (F) *Fa*, and (G) *Sol*.



2. A *triad* is the addition of its *third* and *fifth* to any given note.

3. How many tones and how many semitones are found in the diatonic scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Of three bankrupts, A, B, and C, A can pay 77·5 per cent. of his debts, B 15s. 1d. in the £, and I accept from C £390 instead of £500 which he owes me. How much better do I come off than the creditors in a like sum of A and B respectively?

A pays $\frac{77\frac{1}{2}}{100}$ or $\frac{31}{40}$ of £500 = £387 10s. 0d.
B ,, 15s. 1d. × 500 = £377 1s. 8d.
C ,, £390 0s. 0d.
i.e., I come off better than the creditors of A by £2 10s. 0d.
,, ,, ,, ,, ,, B ,, £12 18s. 4d.

2. How long should £1200 at 4 per cent. be lent in return for the loan of £1920 at 5 per cent. for one year and a half?

$$\left.\begin{matrix}£1200 : £1920 \\ 4 : 5\end{matrix}\right\} :: 1\tfrac{1}{2} \text{ yrs.} : ?$$

$$\frac{3 \text{ yrs.} \times 1920 \times 5}{2 \times 1200 \times 4} = 3 \text{ yrs.} \quad \text{Ans.}$$

3. What is the rate of interest per cent. per annum if I pay £2 10s. 7½d. for the use of £300 for a month?

$$\left.\begin{matrix}£300 : £100 \\ 1 : 12\end{matrix}\right\} :: £2\ 10s.\ 7\tfrac{1}{2}d. : ?$$

$$\frac{£2\ 10s.\ 7\tfrac{1}{2}d. \times 100 \times 12}{300} = 10\tfrac{1}{2} \text{ per cent.} \quad \text{Ans.}$$

4. If a boy's father lends £55, and receives 55s. interest per annum for his loan, and the boy lends 55s. at the same rate of interest, how much should the latter receive at the end of a year?

55s. of interest on £55 = 1s. per £ = $\frac{1}{20}$ of money lent.
∴ the boy should receive $\frac{1}{20}$ of 55s., or 2s. 9d. Ans.

5. What is the average daily attendance of a school of 420 children for a week (= 10 half-days), if 15 per cent. of the scholars absent themselves on Monday forenoon and the rest of the week; and, besides them, there is a number of truants, increasing by 2 a time at each subsequent meeting of the school?

Mon. A.M. meeting = $\frac{85}{100}$ of 420 = 357; P.M. 357 − 2 = 355
Tues. ,, ,, 355 − 2 = 353; ,, 353 − 2 = 351
Wed. ,, ,, 351 − 2 = 349; ,, 349 − 2 = 347
Thur. ,, ,, 347 − 2 = 345; ,, 345 − 2 = 343
Fri. ,, ,, 343 − 2 = 341; ,, 341 − 2 = 339

Total ,, meetings ... ... = 1745; ,, meetings = 1735

$$\frac{1745 + 1735}{10} = \frac{3480}{10} = 348 \text{ average attendance.}$$

FEMALES.

1. Divide $\frac{7(1\frac{1}{2} \text{ of } \frac{3}{14})}{\frac{1}{8}\left(\frac{3}{3\frac{1}{2}} \text{ of } 7\right)}$ by $\frac{5}{14}$, and find the value of $\frac{\frac{1}{4} + \frac{1}{2} + \frac{1}{4}}{2\frac{1}{8} + 3\frac{1}{2} + 4\frac{1}{2}}$

(*a*) $\frac{7(\frac{3}{2} \times \frac{5}{14})}{\frac{1}{8}(\frac{9}{7} \times \frac{7}{1})} \times \frac{1}{10} = \frac{\frac{7}{1} \times \frac{3}{2} \times \frac{5}{14}}{\frac{1}{8} \times \frac{9}{1} \times \frac{7}{1}} \times \frac{1}{10}$

$= \frac{7}{1} \times \frac{3}{2} \times \frac{5}{14} \times \frac{8}{9} \times \frac{7}{8} \times \frac{1}{7} \times \frac{1}{10}$

$= 3\frac{1}{2}$. Ans.

(*b*) $\frac{\frac{1}{2} + \frac{1}{2} + \frac{1}{4}}{\frac{2}{8} + \frac{7}{8} + \frac{9}{8}} = \frac{6 + 4 + 3}{30 + 42 + 54} = \frac{13}{126}$. Ans.

Note.—Multiply numerator and denominator by $1\frac{1}{7}$.

2. A man gave 15 tons of coal amongst the poor, giving to each $1\frac{1}{2}$ cwt., among how many persons did he divide it?

$$\text{No. of persons} = \frac{15 \text{ tons}}{1\frac{1}{2} \text{ cwt.}} = \frac{300 \text{ cwt.}}{\frac{3}{4} \text{ cwt.}} = \frac{900}{5} = 180 \text{ persons.} \quad \text{Ans.}$$

3. A owned $\frac{3}{4}$ of a farm of 300 ac.; he sold $\frac{2}{3}$ of his share to B; and B sold $\frac{1}{2}$ of his share to C; what is the value of C's land at £50 an acre?

£50 × $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of 300 ac. =

$$\frac{£50 \times 1 \times 2 \times 2 \times 300}{4 \times 3 \times 5} = £50 \times 20 = £1000. \quad \text{Ans.}$$

Grammar.

1. '*It* is not now, as it *hath been of yore*;
Turn whereso'er I may,
By night or day,
The *things which* I have *seen* I now can *see no more*.'
WORDSWORTH.

(*a*) Point out the conjunctions in the above, and state to which class of conjunctions each belongs.
(*b*) What kind of sentences are joined to principal sentences by relative pronouns? Illustrate your answer from the above, and give other examples.
(*c*) Parse the words in italics.

(*a*) *As*—subordinative (adv.); *or*, co-ordinative (alternative) conj.
(*b*) *Adjective* sentences are joined to principal sentences by relative pronouns; as, '*which I have seen*;' I met one *whom I knew*. This is the best example *that I can find*.
(*c*) *It*—pers. pron. used indefinitely, 3rd pers. sing. neut. nom. to *is*.
turn—reg. intrans. verb, infin. pres. indef., gov. by *may*.
hath been—subst. verb irreg. *am, was, been*, indic. pres. perfect. 3rd pers. sing. agr. with *it*.
of—prep. gov. obj. case *yore*.
yore—abstr. noun, neut. sing., obj., by *of*.
of yore—an adverbial phrase.
things—com. noun, neut. plur., obj., gov. by *see*.
which—simple rel. pron., referring to '*things*,' 3rd pers. plur., neut., obj., gov. by *have seen*.
seen—complete part. of irreg. verb, *see, saw, seen*, forming a compound tense with *have*.
see—irreg, trans. verb, *see, saw, seen*, infin., pres., gov. by *can*.
no—neg. adv., mod. *more*.
more—adv. of time, mod. *see*.

2. Make three sentences with *for, but*, and *except* used as conjunctions, and three in which they are used as prepositions.

CONJUNCTIONS.

1. Prince Edward fled, *for* the battle was lost.
2. He lived in hope, *but* hope was vain.
3. *Except* ye repent, ye shall all likewise perish.

PREPOSITIONS.

1. Choose out a path *for* me.
2. They all perished *but* him.
3. All the girls passed *except* her.

Geography.

1. Draw a full map of Russia in Europe, and insert the lines of latitude and longitude.

2. Give notes of a lesson on *Mountain Ranges* under these heads:—

(*a*) What is a mountain?
(*b*) What is a range?
(*c*) What is meant by 'the line of perpetual snow,' and what is the cause of it?
(*d*) How do mountains form *boundaries* and *watersheds?*
(*e*) Why do great rivers generally rise in mountains?

Illustrate each of these points as you come to it, from the mountains of Hindostan or British North America.

N.B.—Go *fully* into the examples you mention; do not merely give a string of names.

Notes of a Lesson on *Mountain Ranges.*

(*a*) *What is a mountain?*—A piece of land rising high above the level of the earth's surface, generally applied to elevations over 2,000 feet high—as, Dhawalagiri, 26,826 ft.; Everest, 29,002 ft.; and Kunchinjunga, 27,815 ft.; the highest summits of the Himalayas.

(*b*) *What is a range?*—When mountains extend in lines they are called mountain ranges, or chains; as the *Himalayas* range, running along the northern boundary of India—and the Aravulli Mountains separating the basins of the Ganges and Lower Indus.

(*c*) *Line of perpetual snow, and cause of it.*—The more elevated a place is, the lower is its temperature, and a change of only a few feet will diminish the temperature of a place as much as a change of latitude amounting to many miles. By continuing the ascent in any latitude we at length arrive at what is called the *snow line,* or the *limit of perpetual congelation.* In the tropics this line attains its maximum elevation, and gradually descends as it proceeds to the poles. The height of the snow line is not regulated exclusively by the degree of latitude, but depends very much on the exposure of the place, the character of the prevailing winds, and the depth of snow that has fallen during the winter. For example, the height of the snow line on the south side of the Himalayas is 16,200 ft.—on the north side 17,400 ft.

(*d*) *How do mountains form 'boundaries' and 'watersheds'?*—By forming a natural wall to enclose valleys, mountains serve as boundaries to separate countries and nationalities; thus the *Eastern Ghâts,* on the Coromandel coast, form the E. margin of the plateau of the Dakhan, and the W. Ghâts form the W. wall of the same table-land. On this table-land the languages are essentially different from the dialects of Northern India, showing clearly that mountains form a barrier of communication.

Again, the W. Ghâts form the water-parting as well as *watershed* between the Arabian Sea and the Bay of Bengal, just as the Aravulli Mountains separate the basins of the Ganges and lower Indus, or the Vindhya Mountains separate the Jumna from the Nerbudda.

(*e*) *Why great rivers generally rise in mountains.*—Currents of moist air striking against mountain-sides are driven up towards the summits. As the elevation increases the cold proportionately increases, whence condensation ensues. Mountain regions are thus the source of springs and streams, which, as brooks or torrents, run down the slopes into the valleys and are collected by the main stream as it pursues its way, rapidly or slowly, according to the aspect of the country. For example, the Ganges rises from under a low arch called the 'Cow's Mouth' at the base of a mass of frozen snow, about 14,000 feet above the level of the sea; the Indus rises at an elevation of 18,000 feet and is augmented by five rivers, all taking their rise in the Himalaya range.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Write a short history of the queens of Edward III. and Henry VI.

Philippa of Hainault was the Queen of Edward III. She was a lady of distinguished virtue and heroic courage. During Edward's absence in the French Wars she defeated the Scots at Neville's Cross, and took David, the Scotch king, prisoner (1346). Next year she was present at the Capitulation of Calais, when six of the principal burgesses appeared before Edward to be hanged, according to the terms of the capitulation. The queen, by her entreaties, induced Edward to pardon them and they were set free.

Margaret of Anjou was the Queen of Henry VI. She was high-spirited, ambitious, courageous, and energetic; she was an excellent mother and a most heroic queen. During the Wars of the Roses she bravely raised troops in the cause of her husband. She rejected the arrangement that the crown should fall to the Yorkists on the death of Henry, and returning from Scotland, whither she had fled, collected 20,000 men and defeated York at Wakefield. At St. Albans (1461) she defeated Warwick; but she had to retire northwards, and Edward of York was proclaimed by the title of Edward IV. Immediately after his being accepted king, he marched against Margaret, who had collected 60,000 men in Yorkshire, met her at Towton, and totally defeated her. Margaret and her son fled to Scotland, and in 1464 again attempted an invasion of England, but at Hedgeley Moor and Hexham her forces were routed and dispersed. Margaret escaped, and it is said that she was assisted by one of a band of robbers to make her way over to Flanders. Once more she landed in England, and her small French force being augmented by an army in the west, she met Edward at Tewkesbury (1471). Here she lost her last battle and the life of her young son, who was foully murdered after the fight. Margaret was imprisoned in the Tower, but being ransomed by Louis XI. she was set free, and died (1482).

2. Give the date of the accession of Queen Anne. For what war was this reign remarkable, and what were the chief battles in which the English took part?

Anne ascended the throne in 1702. Her reign is remarkable for the 'War of the Spanish Succession.' The chief battles in which the English took part were Blenheim (1704), Ramillies (1706), Oudenarde (1708), and Malplaquet (1709).

3. What can you tell about the First House of Commons, the Battle of Evesham, and the Mad Parliament?

The First House of Commons met in the reign of Henry III., 1265. It was called by the Earl of Leicester, and for the first time *knights* and *burgesses* were allowed to sit in council with the barons.

In this reign, the king having, by his preference for foreigners, roused the indignation of the barons, was forced to call a council to redress the grievances of the nation. The measures laid down by this council were so 'madly' opposed to the royal authority that the king's supporters named it the 'Mad Parliament' (1258).

In 1265 Prince Edward, son of Henry III., escaped from the guards set over him by Simon de Montfort, raised an army, and defeated the great earl at Evesham. Earl Simon was slain, and great severity shown to the vanquished leaders.

Composition.

Write full notes of a lesson on *Leather and its uses.*

THINGS TO BE SEEN.—*A piece of raw, dry hide—slaked lime—glue—oak-bark—ground oak-bark*—and other things connected with the manufacture of leather.

1. WHAT IT IS.—Leather is made from the skins and hides of animals, such as bullock, doe, buck, bear, kid, chamois.

2. HOW MANUFACTURED.—Skins *cleaned* by cutting off horns, tail, and thin edges; by soaking and kneading them in water to make them soft, then by stirring them about with water containing slaked lime; hair scraped off, lime washed out; skin then scraped clean from fat, blood-vessels, and bits of flesh. These skins next *tanned,* that is, thrown into pits and stirred now and then for several months with water and chips of oak-bark; tanning hardens the gelatine (glue) and so makes the skin hard and less acted on by water; after this, hides removed, dried, and placed between rollers. After tanning, the leather comes into the hands of the *currier,* who damps it, pares the surface till the leather is of equal thickness throughout; then wets, puts it on a slate table, scrapes it, brushes it, hangs it up to dry, rubs it with a mixture of soot and tallow and fish-oil;—this makes the leather soft and pliable for working.

USES.—Leather is used for boots and shoes, gloves and riding trousers, coverings for chairs and sofas, for binding books, for some kinds of aprons, for harness, straps, bags, belts, and other things which can be named by the children.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. Define *point, figure, semicircle, scalene triangle, parallel, straight lines, postulate, axiom.*

A *point* is that which has position but not magnitude.
A *figure* is that which is contained by one or more boundaries.
A *semicircle* is the part of a circle cut off by a diameter.
A *scalene triangle* has three unequal sides.
Parallel straight lines are such as are in the same plane, and which being produced ever so far both ways do not meet.
A *postulate* is a self-evident problem, the use of which is at once granted if required. The three postulates are: 1, The drawing of a straight line from one point to any other point; 2, The producing of a straight line to any length in a straight line; and 3, The drawing of a circle from any centre at any distance from that centre.
An *axiom* is a self-evident proposition.

2. To draw a straight line perpendicular to a given straight line from a given point without it.

Euclid I. 12.

3. To make a triangle of which the sides shall be equal to three given straight lines, but any two whatever of these must be greater than the third.

Euclid I. 22.

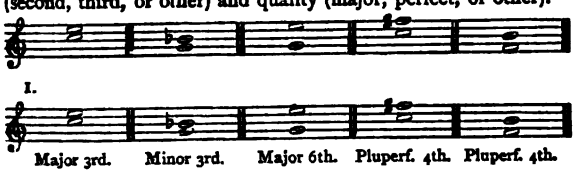
Needlework.

One hour allowed for this Exercise.

Music.

A quarter of an hour allowed for this Paper.

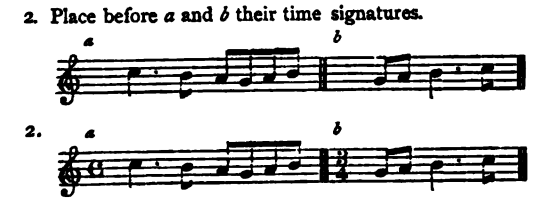
1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).



1.

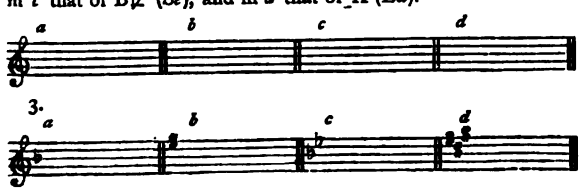
Major 3rd. Minor 3rd. Major 6th. Pluperf. 4th. Pluperf. 4th.

2. Place before *a* and *b* their time signatures.



2.

3. Write in *a* the scale signature of F (*Fa*), in *b* that of G (*Sol*), in *c* that of B♭ (*Se*), and in *d* that of A (*La*).



3.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* 1st *May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What number is that from which, if 5 per cent. be subtracted, $\frac{4}{5}$ of the remainder is equal to 17?

5 per cent. $= \frac{1}{20}$ of the number.
i.e., $\frac{19}{20}$ of the No. remain.
$\therefore \frac{4}{5}$ of $\frac{19}{20}$ of the No. $= 17$
$\frac{1}{5}$,, $= 17$
or No. $= 85$. Ans.

2. The West Riding contains 1708026 acres, and the county of Durham 622476 acres, their populations being respectively 1507511 and 509018; which is the more thickly populated, and by how much per cent.?

Answer to two places of decimals.

Average pop. for West Riding $= \frac{1507511}{1708026} = .8826$ pers. per acre.
,, ,, Durham $= \frac{509018}{622476} = .8177$,, ,,
West Riding is more thickly populated by .0649 ,, ,,
that is, $.0649 \times 100 = 6.49$ per cent. Ans.

3. What incomes will be derived from (*a*) £5500 at $3\frac{1}{2}$ per. cent. stock purchased at par, and (*b*) £5500 invested in the same stock at $102\frac{2}{3}$ respectively? And what fraction is the lesser income of the greater?

(*a*) $\frac{£5500 \times 3\frac{1}{2}}{100} = £192\frac{1}{2} = £192\ 10s.$

(*b*) $\frac{£5500 \times 3\frac{1}{2}}{102\frac{2}{3}} = \frac{£5500 \times 7 \times 3}{308 \times 2} = £\frac{1925}{8} = £187\ 10s.$

$\frac{187\frac{1}{2}}{192\frac{1}{2}} = \frac{375}{385} = \frac{75}{77}$ fraction required. Ans.

4. State and explain the rules for converting recurring decimals into vulgar fractions, taking .629 and 2.4114583 as your examples.

Rule for reducing a Circulating Decimal to a Vulgar Fraction:—
If only the same figures recur, make the repeating part the numerator of the fraction, and place underneath it as many nines as there are digits in the repeating part.

For example:—Let S represent the sum of the series .629629629.....
Then (*a*) 1000 times S = 629.629629.....
But (*b*) S = .629629.....
Subtracting (*b*) from (*a*) 999 S = 629
$\therefore$ S $= \frac{629}{999} = \frac{17}{27}$ in L. T.

But if it be a mixed circulating decimal, subtract the digits which do not recur from the whole expression as far as the end of the first repeating part; take this difference as the enumerator, and for the denominator place as many nines as there are figures in the recurring part, followed by as many ciphers as are figures in the part which does not recur.

For example:—Let S again represent the sum of the series, 2.411458333.....
(*a*) Then 10000000 times S = 24114583.33 .....
(*b*) And 1000000 ,, S = 2411458.33.....
Subtracting (*b*) from (*a*) 9000000 ,, S = 21703125
$\therefore$ S $= \frac{21703125}{9000000} = 2\frac{79}{111}$.

5. If $3\frac{1}{2}$ per cent. consols are at $86\frac{5}{8}$, and $4\frac{1}{2}$ per cent. railway stock at $94\frac{1}{2}$, which is the better investment? And what amount should I then invest in the consols so as to obtain an income equal to that which would arise from £1050 invested in the railway stock?

(*a*) In the 1st case an expense of $£86\frac{5}{8}$ yields $£3\frac{1}{2}$
$\therefore$,, ,, $£94\frac{1}{2}$,, $£3\frac{1}{2} \times \frac{86\frac{5}{8}}{91\frac{1}{2}}$
i.e., $3\frac{5}{12}$.
But in the 2nd case an expense of $£94\frac{1}{2}$ yields $£4\frac{1}{2}$
$\therefore$ the railway stock is the better investment.

(*b*) $\left.\begin{matrix}94\frac{1}{2}:86\frac{2}{3}\\ 3\frac{1}{2}:4\frac{1}{2}\end{matrix}\right\}::£1050:?$

$$\frac{£1050\times86\frac{2}{3}\times4\frac{1}{2}}{94\frac{1}{2}\times3\frac{1}{2}}=\frac{£1050\times693\times9\times2\times2}{8\times2\times189\times7}$$

$$=\frac{£75\times33}{2}=\underline{£1237\ 10s.}\ \text{Ans.}$$

FEMALES.

1. Find the value of

(*a*) 15·625 ÷ 2·5
(*b*) ·015625 ÷ 25

(*a*) $=156\cdot25\div25=\underline{6\cdot25}$. Ans.

(*b*)
$$25\left\{\begin{matrix}5\\5\end{matrix}\right.\left|\begin{matrix}\cdot015625\\ \underline{\cdot003125}\end{matrix}\right.$$
$$\underline{\cdot000625}\ \text{Ans.}$$

2. Show that $\frac{1\cdot5}{\cdot075}\times\frac{3\cdot25}{1\frac{1}{2}}+\frac{1\cdot875}{2\cdot1}\times\frac{3\cdot5}{3\cdot75}=44\cdot1\dot{6}$

(*a*) $\frac{1\cdot5}{\cdot075}\times\frac{3\cdot25}{1\frac{1}{2}}=\left(\frac{1\frac{1}{2}\times3\frac{1}{2}}{\frac{75}{100}\times\frac{1}{2}}\right)=\frac{3\times13\times40\times2}{2\times4\times3\times3}=\frac{260}{6}$

(*b*) $\frac{1\cdot875}{2\cdot1}\times\frac{3\cdot5}{3\cdot75}=\frac{1\frac{7}{8}}{2\frac{1}{10}}\times\frac{3\frac{1}{2}}{3\frac{3}{4}}=\frac{15\times7\times10\times4}{8\times2\times21\times15}=\frac{5}{6}$

$\therefore\ \frac{260+5}{6}=\frac{265}{6}=\underline{44\cdot1\dot{6}}$. Ans.

3. What number must be subtracted from the product of 9·27 and 8·0003, to give the sum of 19, 27·9652, 5·0267, and 17·09?

(*a*)		(*b*)
9·27		19·
8·0003		27·9652
		·003
		5·0267
		17·09
74·162781	−	69·0849 = 5·077881. Ans.

4. Find the value of ·07 of £2 10s., and of ·7365 of 6s. 8d.

(*a*) ·07 of £2·5 = ·175 = 3·5s. = 3s. 6d. Ans.

(*b*) ⅓ of £·7365 = ·2455 = 4·91s. = 4s. 10$\frac{92}{100}$d. Ans.

Grammar.

'Stern *daughter* of the voice of God,
O Duty! if *that* name thou *love*.
Who art a *light* to guide, a rod
To check the *erring* and *reprove*;
Thou who art *victory* and law
When empty terrors overawe.'—ODE TO DUTY.

(*a*) Give the meaning of the above passage in your own words.

(*b*) Parse the words in italics.

(*c*) Distinguish between an adjective sentence and an adverbial sentence, and give examples of both from the above.

(*a*) The voice of Duty may be called the voice of God. At one time she shows clearly the path of conduct in which we are to go, at another she punishes us for straying, and chides our waywardness. She enables us at all times to distinguish our real difficulties, and the extent of our obligations.

(*b*) *daughter*—com. noun, fem., sing., nom. of address or vocative.
that—demonstr. adj., limiting *name*.
love—reg. trans. verb, subjunctive, pres. indef., 2nd pers. sing., agr. with *thou*.
Who—simple rel. pron., referring to '*thou*,' 2nd pers., sing., nom., to *art*.
art—irreg. subst. verb, *am, was, been*, indic., pres., indef., 2nd pers., sing., agr. with *who*.
light—com. noun (here abstr.), neut., sing., nom., after *art*.
erring—adj. used as coll. noun, com., plur. obj., gov. by *check*.
reprove—reg. trans. verb, infin., pres., indef., attrib. to *rod*.
thou—pers. pron., referring to *Duty*, 2nd pers. fem., sing., nom. of address or vocative.
victory—abstr. noun, neut., sing., nom. after *art*.
When—conj. adv., introducing subord. clause, and mod. *overawe*.

(*c*) An adjective sentence or clause qualifies a noun; as, '*who art a light to guide*,' which qualifies *Duty*.
An adverbial sentence or clause modifies a verb or predicate; as, '*When empty terrors overawe*,' which modifies '*art victory and law*.'

Geography.

1. Give notes of a lesson on 'The Mountains and Rivers of Hindostan,' and illustrate it by sketch-maps of the chief river-basins. Insert the lines of latitude and longitude, and explain how they are useful in drawing maps.

N.B.—Do *not* draw a full map of the whole country.

The Mountains and Rivers of Hindostan.

MOUNTAINS.—1. The *Himalaya* ('abode of snow') chain, separating the basin of the Ganges from the upper basin of the Brahmaputra; three loftiest peaks—Everest, 29,002 feet; Kunchinjunga, 27,815; and Dhawalagiri, 26,826 feet. 2. *Aravulli Mts.* form W. wall of plateau of Malwa, and separate the basins of the Ganges and Lower Indus; *Mt. Abu* is the highest summit. 3. Vindhya Hills form S. wall of plateau, and separate the Jumna from the Nerbudda. 4. The *Sautpura Hills* separate the basins of the Nerbudda and Tapti, and are continued E. by the *Mahades Hills*. 5. The Western Ghâts extend for 1000 mls. form the water-parting between the Arabian Sea and Bay of Bengal, and constitute the W. wall of the table-land of the Dakhan. Vast quantities of moisture are deposited on them, and they give rise to all the large rivers of Southern India. 6. The *Nilgiris* S. of Mysore (Maisûr) connect the W. with the E. Ghâts, and form the S. wall of the plateau of Maisûr. Dodabetta is the highest summit. 7. The *E. Ghâts* extend from the Nilgiris in a N.E. direction, and form the E. margin of the Dakhan.

RIVER BASINS INCLINED TO THE ARABIAN SEA.—1. The *Indus* rises in Thibet, penetrates the Himalaya, flows S. to Attock, where it is joined by the *Kabul*: about 400 mls. further down it receives as one stream the five rivers of the Punjaub, and flows by seven mouths into the sea. 2. The *Nerbudda*, from Goondwana, flows W. between the Vindhya and Sautpura Mts. into the G. of Cambay. 3. The *Tapti* flows W. into the G. of Cambay.

RIVER BASINS INCLINED TO THE BAY OF BENGAL.—The *Ganges* issues in a small stream from a mass of perpetual snow on the S. side of the Himalaya Mts., and enters the plains of Hindostan after passing Hurdwar, receives the Jumna at Allahabad, is again swelled by the addition of several large streams in its progress to Patna, where it is three miles broad. About 200 mls. from the sea it branches into a delta, the numerous arms of which form a maze of channels and creeks called the *Sunderbunds*. The western or *Hoogly* branch, which passes Calcutta, is the only navigable one. The eastern branch receives the *Brahmaputra* before it passes into the Bay of Bengal.

The other rivers are the *Kaveri, Punnair, Krishna, Godaveri*, and *Mahanadi*, all flowing eastwards.

Lines of latitude and longitude are useful in giving places the exact relative position which they have on the earth itself, and they form a complete set of guiding lines for drawing a correct representation of any part of the earth.

2. If you were asked by children, 'What sort of a place is Africa?' how should you answer them, so as to give them an idea of the appearance and character of its different parts, and to show them how much more we know about it now than was known fifty years ago?

Africa is a vast table-land, or series of terraces, walled in by sea-coast ranges of mountains. South of the Mediterranean coast ranges lies the Great Desert, or Sahara, a great table-land rising in the middle to 4,000 feet above the sea. A wide tract in the west is said to be below the level of the sea, and it has been proposed to cut a canal from it to the Atlantic, and convert it into an inland sea. The surface of this desert consists of loose sand, gravel, and rocks. It is entirely without rivers. Here and there fertile spots, watered by springs, occur, at which caravans water their camels and rest after their toilsome, burning march across the desert. The sun beats down during summer, and the region is swept by hot winds, often carrying the stifling atmosphere to the shores of Europe. Travellers in the Sahara are often deceived by an appearance called the 'mirage,' presenting the appearance of a lake in which palm-trees are reflected (describe the disappointment of the weary

travellers). South of Sahara is Soudan, a broad, fertile country, containing the *Niger*, in exploring which *Mungo Park* lost his life. The interior is watered by *L. Tchad*. South of Soudan is *Central Africa*, crossed by the Equator, and, therefore, the hottest part of the earth. This used to be considered a barren desert, but a great part of it has within the last fifty years been crossed by travellers, who have found it a fertile and populous region. This region possesses the great lakes of Central Africa, and is drained by three of the great rivers of the world—the *Nile*, which fertilizes Egypt, and flows N.; the *Congo*, or *Livingstone*, flowing W.; and the *Zambesi*, flowing E. South of the Zambesi the country is very varied, being mountainous in the east, having a desert in the west, and bounded on the south by the Orange River. South of the Orange River is the most prosperous part of the African Continent. It consists of mountains, table-lands, and valleys, with abundance of pasture and cultivation. (*The three terraces of Cape Colony to be described.*) The '*Great Karoo*,' the highest of the three, is about a hundred miles broad. For nine months it is nearly bare, but during the other three it yields good pasture. The great travellers, Livingstone, Speke and Grant, Baker, Stanley, Cameron, and Burton, have cleared up the mysteries of Central Africa.

SECOND PAPER.

History.

Two hours and a half allowed.

1. Explain the terms Roundhead, Jacobite, Puritan, Regicide, and Chartists.

Roundhead was applied to those who supported the Parliament and wore their hair short, as opposed to the Royalists, who wore long hair, covering their shoulders.

Jacobite was applied to the partisans of James II., his son, and grandson. Derived from Lat. Jacobus—James.

The *Puritans* were seceders from the English Church, so-called on account of their acknowledging only the '*pure* Word of God,' without 'note or comment.' They were afterwards named *Nonconformists*.

The *Regicides* were those more closely connected with the trial and execution of Charles I.

The *Chartists* were those who, in 1838, promulgated the political system demanding the *People's Charter*, consisting of five principles—universal suffrage, annual parliaments, stipendiary members, vote by ballot, and electoral districts.

2. Give a short account of the trial of the Seven Bishops.

In 1688 William Sancroft, Archbishop of Canterbury, and six bishops of his province, signed a petition against the Second Declaration of Indulgence issued by James II. The King resolved to bring the petitioners before the Court of King's Bench on a charge of seditious libel. The 'Seven Bishops' were committed to the Tower amid marks of public sympathy. All Protestants regarded them as the champions of Protestantism against Rome. The main point at issue in the Bishops' trial was, as the Crown lawyers argued, 'a false, malicious, and seditious libel,' and this involved inquiry into the subject's right to petition for redress of grievances. The trial, at which not one of the judges ventured to say that the Declaration of Indulgences was legal, ended with a verdict of '*Not guilty*,' and at this result the delight of the nation knew no bounds.

3. Mention some of the most remarkable inventions of the nineteenth century, with names of the inventors.

Application of Steam-power to locomotives by *George Stephenson*.
Application of Electricity to convey intelligence by *Wheatstone and Cooke*.
Steam-printing-press (the Walter) by *Messrs. Macdonald and Calverly*.
Machines for working in iron by *Joseph Bramah*.
Steam-hammer and ram by *James Nasmyth*.
Rifled guns by *Joseph Whitworth*.
Sewing Machines by *Joseph Howe*.
Electric lighting by *Edison*.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Pathetic*.

Write in small hand, as a specimen of copy-setting, *Englishmen know little of the French navy*.

Composition.

Write from memory the substance of the passage read out by the Inspector.

Euclid.

[All generally understood abbreviations for *words* may be used.]

1. All the interior angles of any rectilineal figure together with four right angles are equal to twice as many right angles as the figure has sides.

See Corollary to Euclid I. 32.

If the figure be equiangular and four interior angles be equal to seven right angles, find the number of sides.

Every angle $= 1\frac{3}{4}$ right angle
and let x denote the number of angles, which = also No. of sides
then $1\frac{3}{4}x+4$ right angles $= x$ sides $\times 2 =$
or $7x+16 = 8x$
i.e., $x = \underline{16} =$ No. of sides. Ans.

2. If a parallelogram and a triangle be upon the same base and between the same parallels the parallelogram shall be double of the triangle.

Euclid I. 41.

3. To describe a square upon a given straight line.

Euclid I. 46.

Algebra.

MALES.

1. Find the value of $x^3-3x^2y+3xy^2-y^3$, when $x=\frac{a+b}{2}$, $y=\frac{a-b}{2}$

since $x^3-3x^2y+3xy^2-y^3=(x-y)^3$
and since $x-y=\frac{(a+b)-(a-b)}{2}=b$
then the value of the expression $= \underline{b^3}$. Ans.

2. Find the G. C. M. of $91x^2y(x^3-3ax^2+2a^2x-2a^3)$, and $65xy^2(x^3+ax^2-a^2x+2a^3)$

(*a*) $91x^2y=(13xy)7x$, and $65xy^2=(13xy)5y$.
then $13xy$ = their G. C. M.

(*b*) As there is no common measure in the other factors $\underline{13xy}$ is the G. C. M. required.

3. Solve the equations—

(1) $\frac{1}{4}(3x+\frac{2}{3})-\frac{1}{7}(4x-6\frac{2}{3})-\frac{1}{2}(5x-6)=0$

(2) $\frac{6x+7}{9x+6}-\frac{5x-5}{12x+9}=\frac{1}{12}$

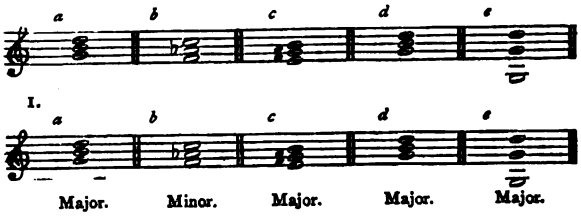
(1) Multiplying the equation by 14 we obtain
$3x+\frac{2}{3}-2(4x-6\frac{2}{3})-7(5x-6)=0$
clearing of fractions $9x+2-24x+40-105x+126=0$
changing sides and signs $-9x+24x+105x = 126+20+2$
$120x = 168$
$x = 1\frac{2}{5}$

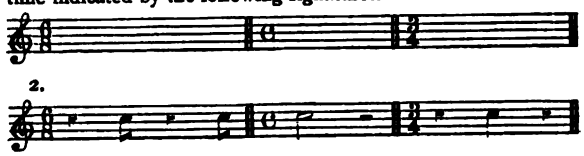
(2) Clearing of fractions—

$72x^2+138x+63-45x^2+15x+30=\frac{1}{12}(108x^2+153x+54)$
$27x^2+153x+93=\frac{1}{12}(108x^2+153x+54)$
$324x^2+1836x+1116=108x^2+153x+54$
$324x^2-108x^2+1836x-153x=54-1116$
$216x^2+1683x=-1062$
$24x^2+187x=-118$
$x^2+\frac{187}{24}x=-\frac{118}{24}$
$x^2+\frac{187}{24}x+(\frac{187}{48})^2=\frac{34969-11328}{2304}=\frac{23641}{2304}$
$x+\frac{187}{48}=\pm\frac{153\cdot75\ldots}{48}$
$x=\pm\frac{153\cdot75\ldots-187}{48}$
$\therefore\ x=-\frac{33\cdot25}{48}$ or $-\frac{340\cdot75}{48}$
$=-\underline{\cdot6927}$ or $-\underline{7\cdot098}$ Ans.

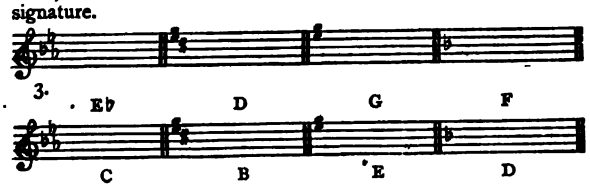
Music.

A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. A broker, whose commission is $\frac{1}{4}$ per cent., receives £4064 14s. 7½d. to invest in bank stock at 188⅛; what amount of stock can he buy?

£100 is got for 188⅛ + ¼, or £188⅜
£1 " " £$\frac{400}{755}$
∴ £4064 14s. 7½d. " " £$\frac{4064\ 14^{s}.\ 7\frac{1}{2}d.\ \times\ 400}{755}$
i.e. £$\frac{1625892\ 10s.}{755}$ = £2153 10s. Ans.

2. I speculate and lose 10 per cent. of my capital; I then speculate with the remainder, and lose 20 per cent. of that. How much per cent. must I gain by a third speculation, on the sum still remaining, in order to be as well off as when I started?

Say the capital was £100.
∴ After 1st speculation he has £90 left,
and " 2nd " " ⅕ of £90, or £72.
Therefore to be as well off as at first the £72 must gain £18,
i.e. ¼ of itself, or 25 per cent. Ans.

3. A person invests in the 3 per cents. so as to receive 3 per cent. clear on his investment when the income tax is 9d. in the £. What per centage will he receive if the income tax be increased to 1s. in the £?

When he has 231 parts clear out of the £ he has 3 per cent. What percentage will he have when he has 228 parts clear?

231 : 228 :: £3 : ?
£$\frac{3\times228}{231}$ = £$\frac{228}{77}$ = £2 19s. 2$\frac{5}{7}$d. Ans.

4. Explain the difference between true and mercantile discount.

A debt is paid June 23, by a bill dated at six months; supposing the bill to be discounted October 14, the real discount would be £3 10s. Find the amount of the bill, the rate of discount being 5 per cent.

The Bill is due Dec. 26, reckoning the days of grace; and therefore it has 73 days to run after Oct. 14.
Discount on £100 for 73 days at 5 per cent. = £1.
∴ £1 : £3½ :: £101 : ?
£101 × 3½ = £353 10s. Ans.

5. Simplify— $\frac{2\times\sqrt{(1+\frac{1}{4})}\div\sqrt{(1-\frac{1}{4})}}{5\times\sqrt{(1+\frac{1}{4})}\times\sqrt{(1-\frac{1}{4})}}$

Otherwise $\frac{\sqrt{(4\times\frac{1}{4})}\div\frac{1}{4}}{\sqrt{(25\times\frac{1}{4})}\times\frac{1}{4}}$ =

$\sqrt{\frac{16\times5}{3\times4}}\ \div\ \sqrt{\frac{100\times4}{3\times5}}$ =

$\sqrt{\frac{16\times5\times3\times5}{3\times4\times100\times4}}$ =

$\sqrt{\frac{1}{4}}$ = ½. Ans.

6. Find the compound interest on £100 for 5 years at 5 per cent.; and apply your result to find the amount of £8640 in the same time.

Interest of £1 for a year at 5 per cent. = £·05
Amount of " " = £1·05
£100 × $(1{\cdot}05)^5$ = £127·62815625 amount of £100
∴ £100 : £8640 :: £127 62815625 : amount required.
£$\frac{127{\cdot}62815625\ \times\ 8640}{100}$ = £11027·0727 =
£11027 1s. 5$\frac{1}{25}$$\frac{7}{25}$d. Ans.

FEMALES.

1. At what rate per cent. will £142 10s. amount to £163 13s. 11½d. in 4½ years?

Interest for 4½ years = £163 13s. 11½d. − £142 10s.
= £21 3s. 11½d.
∴ £142 10s. : 100 } :: £21 3s. 11½d. : ?
4½ yrs. : 1 yr. }
$\frac{£21\ 3s.\ 11\frac{1}{2}d.\times100\times4}{142\frac{1}{2}\times17}$ = $\frac{£84\ 15s.\ 9d.\times200}{285\times17}$
= £$\frac{169571}{4845}$
= £$\frac{3\,3\,2\,1\,5}{0\,0\,0\,0}$
= 3½ p.c. Ans.

2. A and B own a farm together; A owns $\frac{7}{11}$ of it, and B the remainder, and the difference between their shares is 17 ac. 0 ro. 20 po. Find the value of the farm if ⅝ of it be worth £50 an acre, and the rest of it £46 an acre.

Farm = 17 ac. 0 ro. 20 pr ÷ $(\frac{7}{11}-\frac{5}{11})$ = 17 ac. 0 ro. 20 po. × ½
= 102 ac. 3 ro.

	£	s.	d.
∴ ⅜ of 102¾ ac. at £50 per ac. = £50 × $\frac{3\times411}{32}$ = £50 × 1$\frac{3\,8\,4}{8\,0\,0}$ =	1,926	11	3
⅝ of 102¾ ac. at £46 per ac. = £50 × $\frac{5\times411}{32}$ = £50 × 2$\frac{0\,5\,5}{8\,0\,0}$ =	2,954	1	3
Total value of farm =	£4,880	12	6

3. If 4 p.c. be lost by selling linen at 2s. 9d. a yard, at what price must it be sold to gain 10 per cent.?

96 : 110 :: 2s. 9d. : ?
$\frac{33d.\times110}{96}$ = $\frac{605d.}{16}$ = 3s. 1$\frac{13}{16}$d. Ans.

4. If A can do a piece of work in 10 days, and A and B can do it together in 7 days, in what time would B alone do it?

A does $\frac{1}{10}$ in 1 day; or $\frac{7}{70}$
A and B do $\frac{1}{7}$ " " ; " $\frac{10}{70}$

∴ B does $\frac{3}{70}$ in 1 day
or the whole in $\frac{70}{3}$ = 23⅓ days. Ans.

Grammar.

1. 'The vile strength man wields
For earth's destruction, thou dost all despise,
Hurling him from thy bosom to the skies."
Byron's Address to the Ocean.

(*a*) Point out the enlargement of the subject in the above, and give examples of the various ways in which the subject may be enlarged.

(*b*) Distinguish between enlargement and extension; and write out four sentences; two as examples of enlargements, two as examples of extensions.

(*a*) The enlargement of the subject is '*Hurling him from thy bosom to the skies*' enlarged by a participal phrase.

Other enlargements are:—

1. One or more adjectives:—*This old, red* book is mine.
2. Words in Apposition:—Garfield, *the President*, was assassinated.
4. A prepositional (adjective) phrase:—The fear *of man* is a snare.
5. A noun or pronoun in the possessive case:—*Harry's* uncle has come.
6. The gerundial infinitive:—Bread *to eat* was scarcely to be got.

(*b*) When we attach to a noun or pronoun an adjective, or a word or phrase equivalent to an adjective, by which we indicate more precisely that for which the noun or pronoun stands, this word or phrase is called an *enlargement:* as:—

1. William *of Normandy* was a man *of great ambition.*
2. Sentences *requiring little thought* can be written at once.

Any word or phrase which modifies or defines more clearly, the meaning of the predicate is called an *extension*, as:—

1. I stood (*a*) *in Venice* (*b*) *on the Bridge of Sighs.*
2. *So* sinks the day-star *in his ocean-bed.*

2. Parse each word in the following:—

I cannot help wondering at what you could see in my face, to think me a proper mark for deception.

PARSING.

I— pers. pron., 1st per. com., sing., nom. to *cannot.*
cannot—irreg. defec. verb. *can, could*, neg. form. indic. pres. indef. agreeing with *I.*
help—reg. trans. verb. infin. pres. indef. gov. by *can.*
wondering at—gerund (verbal noun) obj. gov. by *help*, and governing by its verbal force *what you could see in my face.*
what—rel. pron. (antecedent suppressed) neut. 3rd pers. sing., obj. gov. by *see.*
You—pers. pron. 2nd pers., com. plur. nom. to *could.*
could—irreg. defec. verb. *can, could*, indic. past indef. 2nd pers. plur. agr. with *you.*
see—irreg. trans., verb, *see, saw, seen*, infin. pres. indef. gov. by *could.*
in—prep. gov. obj. case *face.*
my—pronom. pos. adj. limiting *face.*
face—com. noun, neut., sing., obj., gov. by *in.*
to think—irreg. trans. verb, *think, thought, thought*, inf. pres. indef. gov. by some phrase like '*which caused.*'
me—pers. pron. 1st pers. sing., com, obj. gov. by *think.*
a—indef. art. (or adj.) joined to mark.
proper—adj. qual. *mark.*
mark—com. noun, neut. sing. obj. in apposition with *me.*
for—prep. gov. obj. case *deception.*
deception—abstr. noun, neut., sing. obj. gov. by *for.*

3. What are suffixes? Give examples of some which are of Teutonic (or German) origin, and of some which are of Latin origin, pointing out what each denotes.

Suffixes are syllables added to the end of a word root to modify its meaning, as:—

SUFFIXES OF TEUTONIC ORIGIN.

1. *—er* or *—ar*,—meaning a *person* or *doer*,—*singer, baker, bigsar, liar.*
2. *—el,—le*, meaning *instrument*,—*shovel, girdle, shuttle.*
3. *—en—kin*, meaning diminutive,—*kitten, lambkin, pipkin.*

SUFFIXES OF LATIN ORIGIN.

1. *—tor—sor—or*, meaning *doers* or *agents*;—*doctor, successor, emperor.*
2. *—ble—cle,—cre*, meaning *instrument* or *place of some action*; —*stable, obstacle, lucre.*
3. *—al—an—ary* forming adjectives; *legal, pagan, necessary.*

Geography.

Answer two Questions.

1. Give notes of a lesson on '*Deltas*,' showing what they are, why they are so called, and how they are formed. Give as many examples as you can, and draw little sketch maps in illustration.

DEFINITION.—The term 'Delta' is applied more especially to that part of Lower Egypt which being comprised between the two main branches of the Nile and the sea had a triangular form somewhat resembling the Greek letter Δ. The same name is now generally given to all river-mouths of similar form. (*Draw sketch on blackboard and compare shape to a fan.*)

HOW FORMED.—When the river courses through a soft or sandy country it brings down mud in the water. As long as this water is running fast the mud is carried along; but when it meets the sea and comes to rest at its mouth, the mud falls down and forms a bed or bank between the river and the sea.

If there is a tide at the mouth of the river it will wash away the mud as fast as it is thrown down and prevent the delta from forming. Therefore the principal deltas occur in seas where there is little or no tide, as in the Mediterranean, Caspian, Gulf of Mexico.

EXAMPLES OF DELTAS.—Mouth of Nile, '*The* Delta'; mouths of the Po, the Ebro, in the Mediterranean; of the Volga, in the Caspian; of the Mississippi, in the Gulf of Mexico; Holland is a large delta of very ancient date formed at the mouths of the Rhine and Meuse; Holland and Lower Egypt are good examples of the way in which land is made out of the sea by the agency of a river; in India, the delta of the Ganges is called the Sunderbunds.

2. A traveller speaks of having seen the sun at midnight. Where must he have been? And how was it that he could see such a sight?

To have seen the sun at midnight the traveller must have been well up in Norway or Sweden, say at Hammerfest, where the sun never sets for two months in summer. In fact, these high latitudes must be enjoying their long day at this very season. This strange phenomenon may be explained as follows:—In the annual motion of the earth round the sun, and while turning on its axis, it passes through the varieties of day and night, summer and winter, which we enjoy. This variety of season is caused by the parallelism of the earth's axis, that is, by the pole or end of the axis pointing always to the same point among the fixed stars. So that when the sun is exactly over the equator at midday, day and night are equal over the whole globe, as it proceeds north or south in tracing out that imaginary track the ecliptic, he either lengthens or shortens the day. If he comes north, as he is doing at this season, our day continues to lengthen till about the 21st of June, which may be called the middle of the long Arctic day. The North Pole and a considerable portion of the earth's surface in its neighbourhood are situated within the enlightened half, therefore, at this point of the earth's wanderings it is continual day at the North Pole, and in all that region of the earth which encircles this pole, or within the *Arctic Circle.* On the other hand, the opposite or South Pole, with all the region comprised within the *Antarctic Circle* is in total darkness.

3. If a canal is ever cut between the Atlantic and the Pacific Oceans, through what part of America will it run? What sort of country will it have to be cut through? What will be the use of it? And what countries will find it convenient for their trade?

If a canal is ever cut between the Atlantic and the Pacific, it will be cut through the Isthmus of Panama, which has been repeatedly surveyed with the object of finding a route for a canal to connect the two oceans.

The average breadth of the isthmus is forty miles, but in one part it is narrowed to less than thirty miles. The surface is undulating, and the hills which extend through the isthmus are not more than 270 feet above the level of the Pacific. The soil is very fertile, and a great quantity of rain falls. The country is very rich in vegetable productions, and among the minerals are gold, copper, iron, and tin. The isthmus has some good harbours. There is a railway across it from Colon on the Atlantic to Panama on the Pacific. Starting from Aspinwall, in an un-

healthy marsh, the railway passes first through marshy ground, then through a dense tropical forest and the highest ground of the isthmus, after which it descends rapidly to the town of Panama.

The importance of a canal to the trade between European commercial countries, such as Britain, France, Germany, Italy, and the ports on the Pacific coast, and in as great a degree to the United States, is apparent from the great increase in the trade of these ports since the working of the railroad commenced. The route from Britain to her Australian colonies by Panama would almost lie in a straight line, and save at least 2,000 miles. The long and dangerous voyage round Cape Horn would also be saved.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Explain the terms Bretwalda, Witanagemot, Crusader, Cavalier, and Balance of Power.

A *Bretwalda* was the chief of the kings of the Heptarchy, who exercised a certain undefined power over the other rulers.

Witanagemot was the great assembly of ecclesiastical and secular lords, etc., which formed the council of state under our Saxon kings, and was the germ of our present Parliament.

A *Crusader* was one who fought in the Holy wars, and wore a *cross*, fighting nominally at least, for the honour of the cross. Each nation had its special colour, that for England being *white*. Richard *Lionheart* led the third Crusade.

A *Cavalier* was an adherent of Charles I., and wore his hair hanging over his shoulders. Those of the opposing party wore short hair and were called *Roundheads*.

Balance of Power means the States of Europe so balanced that no one nation shall have such a preponderance as to endanger the independence of another.

2. Give dates of the following events:—Conquest of Ireland, Pilgrimage of Grace, Battle of Agincourt, American Independence. Write a short account of one of them.

Conquest of Ireland (1171).—Dermot, of Leinster, the king or chieftain of one of the several Irish States, being expelled from the throne, came to England asking assistance; and having done homage to Henry II., returned to Ireland with English knights and archers. He was followed by 'Strongbow,' Earl of Pembroke. These easily defeated the ill-armed Irish, and took possession of a number of towns and strong places. Henry himself landed in Dublin (1171), and received the homage of many native princes.

Pilgrimage of Grace (1536).—When Henry VIII., assisted by Cromwell, his vicegerent in church affairs, brought about the dissolution of the smaller monasteries, and appropriated their revenues; the North-country people, who clung to the old ways, broke out in revolt. The Yorkshire rebellion, led by one Robert Aske, was called, '*The Pilgrimage of Grace.*'

Battle of Agincourt (1415).—At Agincourt, not far from Crêcy, Henry V. met a French Army four or five times as numerous as his own. A great battle followed, in which the French were thrown into confusion by the skill and rapidity of the English archery. The French commander, and many thousands of his knights fell, and Henry returned home making a triumphant entry into London with his prisoners.

American Independence (1783).—Mr. Grenville, prime minister in the reign of George III., having declared that Americans ought to pay part of the British taxes, ordered their newspapers to be 'stamped,' like those in England. Upon this, the Americans refused to hold any commerce with Britain, and threw a cargo of taxed tea into the sea at Boston. Lord North now become premier, thereupon declared war against America, which lasted for eight years (1775-1783). The first battle was fought at Bunker's Hill. The principal British generals were Howe, Burgoyne, Clinton, and Lord Cornwallis; and the principal American commander was George Washington. Mr. Fox having succeeded to the premiership, formed a Whig ministry, which declared America independent (1783).

3. Mention the most celebrated writers of prose and poetry during the eighteenth and nineteenth centuries, with the titles of their best-known works.

PROSE.

Joseph Addison	...	'Tatler' and 'Spectator.'
Jonathan Swift	...	'Gulliver's Travels.'
Daniel Defoe	...	'Robinson Crusoe.'
Henry Fielding	...	'Tom Jones.'
David Hume	...	'History of England.'
Dr. Samuel Johnson	...	'Lives of the Poets.'
Dr. Wm. Robertson	...	'History of Scotland.'
Adam Smith	...	'Wealth of Nations.'
Oliver Goldsmith	...	'Vicar of Wakefield.'
Robert Southey	...	'Life of Nelson.'
Sir Walter Scott	...	'Waverley Novels.'
Thomas Carlyle	...	'French Revolution.'
Lord Macaulay	...	'History of England.'
Charles Dickens	...	'Pickwick Papers.'
W. M. Thackeray	...	'Vanity Fair.'
John Ruskin	...	'Modern Painters.'

POETRY.

Alexander Pope	...	'The Iliad,' 'Essay on Man.
James Thomson	...	'The Seasons.'
Oliver Goldsmith	...	'Deserted Village.'
Robert Burns	...	'Tam O'Shanter.'
William Cowper	...	'John Gilpin.'
Samuel T. Coleridge	...	'Ancient Mariner.'
William Wordsworth	...	'The Excursion.'
Robert Southey	...	'Wat Tyler.'
Lord Byron	...	'Childe Harold.'
Sir Walter Scott	...	'The Lady of the Lake.'
Thomas Campbell	...	'Pleasures of Hope.'
Thomas Moore	...	'Irish Melodies.'
Lord Macaulay	...	'Lays of Ancient Rome.'
Alfred Tennyson	..	'In Memoriam.'
Robert Browning	...	'Dramatic Lyrics.'

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Pathetic.*

Write in small hand, as a specimen of copy-setting, *Englishmen know little of the French navy.*

Composition.

Write a short essay on *the Watering-places of England.*

The watering-places of England may be comprised under three heads—namely, 'spas,' 'sea-side resorts,' and 'those which combine the characters of both spa and sea-side.'

The word 'spa' is derived from a town of that name in Belgium, noted for its medicinal springs. Some of the English spas have wells of water impregnated with *saline* ingredients, such as Epsom (from which we have Epsom salts), Clifton, Bath, Leamington, Matlock, and Buxton. Others, again, are impregnated with iron, and called *chalybeate* springs, the taste of these waters being of an inky character, and decidedly nauseous; such are the wells of Tunbridge, Brighton, Great Malvern, and Harrogate (from which we have Harrogate salts).

Many visitors reside at these places, where huge palatial hydropathic establishments have been erected for the convenience of patients; but many people frequent them not for drinking the waters, but merely as a relaxation, and for the enjoyment of the society always to be found there. Certain wells are recommended for certain diseases; and though the waters can be bottled and sent to all parts of the world, yet there can be no doubt that, in addition to all the advantages to be derived from change of scene, etc., it is better to drink them as they issue from the springs.

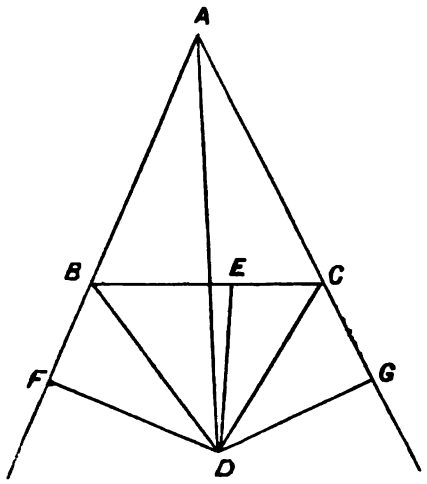
The 'sea-side resorts' of England are numerous on all her coasts, but more especially may be noted those on the south, where climate and natural position render them both beneficial and attractive. The very names of Torquay, Hastings, Isle of Wight, Brighton, Ramsgate, Scarborough, and Herne Bay bring longing to the invalid, and visions of holiday and delicious rest to those who require merely to recruit their jaded energies.

Euclid.

[All generally understood abbreviations for *words* may be used.]

1. If two exterior angles of a triangle be bisected, the line

drawn from the point of intersection of the bisecting lines to the opposite angle of the triangle will bisect that angle.



Let the sides AB, AC of any triangle ABC be produced, the exterior angles bisected by two lines which meet in D, and let AD be joined, then AD bisects the angle BAC.

For draw DE perpendicular on BC, also DF, DG, perps. on AB, AC produced if necessary.

Then because in the triangles BDF, BDE, BD is common to the two, and angles at E and F are equal, as also the angles at B, then (by I. 26) the triangles are equal in every respect, and ∴ DF = DE.

In the same manner DG = DE.

Wherefore DF = DG, being equal to the same thing.

Again, the sq. on DA = sqs. on DF, FA or sqs. on DG, GA that is the sqs. on DF, FA = the sqs. on DG, GA, of which the sq. on DF is equal to the square on DG; hence AF = AG.

Now since the side FA = the side AG and AD is common to the two triangles ADF, ADG, and since the base DF is equal to the base DG, then (I. 8) the angle FAD = the angle DAG, that is BAC is bisected by the straight line DA. 2 E. D.

2. If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the parts.

Euclid II., 4.

3. To divide a given straight line into two parts, so that the rectangle contained by the whole, and one of the parts, shall be equal to the square on the other part.

Euclid II., 11.

Algebra.

1. Prove that $(5a+4b+3c)^2-(3a+4b+5c)^2=16\,(a-c)\,(a+b+c)$

(*a*) $(5a+4b+3c)^2 = 25a^2+16b^2+9c^2+40ab+30ac+24bc.$

(*b*) $(3a+4b+5c)^2 = 9a^2+16b^2+25c^2+24ab+30ac+40bc.$

∴ Subtracting (*b*) from (*a*) $16a^2 - 16c^2 + 16ab - 16bc. =$
$16(a^2-c^2+ab-bc)=$
$16\,(a^2+ab+ac-ac-bc-c^2)=$
$16\,\{a\,(a+b+c)-c\,(a+b+c)=$
$16\,(a-c)\,(a+b+c)$ 2. E. D.

2. Simplify $\frac{2\,(2a-b)}{9a^2-4b^2}+\frac{1}{3a-2b}$, and $\frac{1}{3a+2b}+\frac{2\,(2a+b)}{9a^2-4b^2}$; and divide the one result by the other.

(*a*)

$$\frac{2\,(2a-b)}{9a^2-4b^2}=\frac{4a-2b}{9a^2-4b^2}$$

and $$\frac{1}{3a-2b}=\frac{3a+2b}{9a^2-4b^2}$$

By addition we get $\frac{7a}{9a^2-4b^2}$ for 1st result.

(*b*)

$$\frac{1}{3a-2b}=\frac{3a-2b}{9a^2-4b^2}$$

and $$\frac{2\,(2a+b)}{9a^2-4b^2}=\frac{4a+2b}{9a^2-4b^2}$$

By addition we get $\frac{7a}{9a^2-4b}$ for 2nd result.

$$\therefore \frac{7a}{9a^2-4b^2}\div\frac{7a}{9a^2-4b^2}=\frac{7a\,(9a^2-4b^2)}{(9a^2-4b^2)7a}=1.$$ Ans.

3. Solve the equations :—

$$(1)\ \begin{cases}125x-124y=24\cdot9\\ 9y-8\tfrac{4}{5}x=1\cdot6\end{cases}$$

$$(2)\ 35x^2-3x=494$$

(1) $125x-124y=24\cdot9$

$9y-8\frac{4}{5}x=1\cdot6$ or $45y-44x=8$

$$y=\frac{8+44x}{45}$$

Substituting for y in 1st equation

$$125x-124\left(\frac{8+44x}{45}\right)=24\cdot9$$

$$5625x-992-5456x=1120\cdot5$$

$$169x=2112\cdot5$$

$$x=12\tfrac{1}{2}$$ Ans.

Hence $y=12\frac{3}{5}$ Ans.

(2) $35x^2-3x=494$

$x^2-\frac{3}{35}x+(\frac{3}{70})^2=\frac{494}{35}=\frac{3249}{70}$

$x^2-\frac{3}{35}x+\frac{9}{4900}=\frac{69160+9}{4900}=\frac{69169}{4900}$

$x-\frac{3}{70}=\pm\frac{263}{70}$

$x=\frac{3}{70}\pm\frac{263}{70}=3\frac{1}{2}$ or $-3\frac{5}{7}$ Ans.

Mensuration.

MALES.

Answer *one* Question.

1. A rectangular field is 440 yds. long, and 154 yds. wide; find its area in acres. Also find the areas of the portions into which it is divided by a straight line drawn from the middle point of one side to one of the opposite corners.

Area = 440 yds. × 154 = 67760 sq. yds. = $\frac{67760}{4840}$ ac. = 14 ac. Ans.

Now since the line drawn from the middle of one side to the opposite corner cuts off one-fourth on one side and three-fourths on the other—

then $\frac{1}{4}$ of 14 ac. = $3\frac{1}{2}$ ac. and $\frac{3}{4}$ of 14 ac. = $10\frac{1}{2}$ ac.

2. From a square is cut out the inscribed circle; what fraction of the square is left?

Since it has been found by experiment that the area of a square, whose side is unity, is greater than the area of the inscribed circles by the difference between unity and ·7854

∴ the remainder = 1 − ·7854 = ·2146 =
$\frac{2146}{10000}=\frac{1073}{5000}$ of the square. Ans.

Needlework.

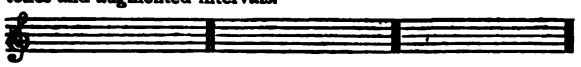
FEMALES.

One hour allowed for this Exercise.

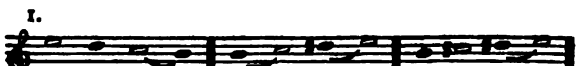
Music.

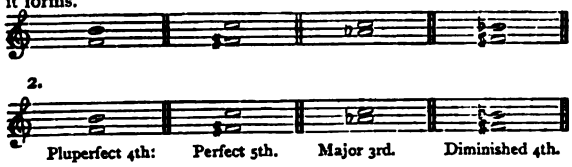
A quarter of an hour allowed for this Paper.

1. Write the upper tetrachord of E (*Mi*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



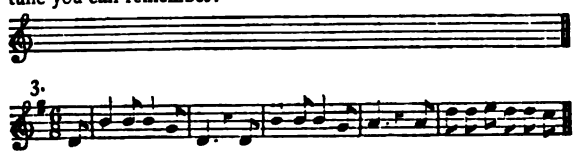
1.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.

2.

Pluperfect 4th: Perfect 5th. Major 3rd. Diminished 4th.

3. Write, from memory, the first four or more measures of any tune you can remember.



3.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR JULY, 1882.

EXERCISE VIII.

(1) $x-y$, $x-a-b$. (2) $8a^2bc$. (3) $3a+2b-3c$. (4) $48xyz$. (5) $6a-3b+8c+1$. (6) $3x^3-9x^2+10x-14$. (7) $x+y+z-a-b-c$. (8) $a+c$. (9) $-b+c$. (10) $(x+y)-(x-y)$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR JULY, 1882.

STANDARD III.

A. 1. 41,212—7.
2. 26,817—20.
3. 2,993,088—40.

B. 1. 93,964—417.
2. 889—18386.
3. 67—4908.

C. 1. £199 16s. 7½d.
2. £714 13s. 9½d.
3. £162,455 2s. 9½d.

D. 1. 652,546 farthings.
2. 34,212 apples.
3. 7,608.

E. 1. 651 slates.
2. £466 13s. 4d.
3. 582—41,963.

F. 1. £9,462 11s. 6½d.
2. 14,498,894.
3. 77—897,170.

ADVANCED EXAMINATION.

1. 6989,378,011 farthings.
2. 252 tons.
3. £300.

STANDARD IV.

A. 1. £19,218 7s. 2½d.
2. £60,980 5s. 2½d.
3. £264 19s. 10½d.—18.

B. 1. £44,719 6s. 9½d.
2. 1,021,440 oz.
3. £26 14s. 1½d.—41.

C. 1. 2279 t. 14 c. 3 qr. 24 lb. 7 oz.
2. £259 8s. 6½d.
3. 1s. 6½d.—467,920.

D. 1. 2s. 2½d.
2. 506,108,100 sec.
3. 322 shirts, and 2 yd. 3qr. 2 nl. left.

E. 1. £67 19s.
2. £661,245 18s. 9d.
3. £151 5s.

F. 1. £81 14s. 8½d.—2505.
2. 5,487 lb. 4oz. 15 dwt. 8 gr.
3. 301 ton. 12 cwt. 2 qr. 9 lb.

ADVANCED EXAMINATION.

1. 42½ min. past 7.
2. £60 19s. 6d. gain.
3. 8 ton. 9 cwt. 21 lb. 12 oz. 9 dr.—4663.

STANDARD V.

A. 1. £81 17s. 3½d.
2. £180 11s. 2½d.
3. £357 17s. 9½d.

B. 1. £346 14s. 7½d.
2. £7,550 3s. 1½d.
3. £5 6s. 9½d.

C. 1. £6,988 5s. 6½d.
2. £72,211 17s. 2½d.
3. £6 3s. 8½d.

D. 1. 220 horses.
2. £37,339 2s. 5½d.
3. £268 17s.

E. 1. £4577 15s. 8½d.
2. 169.
3. £63 15s. 9d.

F. 1. £117 12s. 7½d.
2. £135 8s. 4d.
3. £84 1s. 0½d.

ADVANCED EXAMINATION.

1. £61 0s. 11½d.
2. 37½ lb. each cheese.
3. £61 4s.

STANDARD VI.

A. 1. $12\frac{7}{13}$.
2. $\frac{8}{9}$.
3. ·03359375.

B. 1. $\frac{2}{45}$.
2. ·00502.
3. £2 19s. $10\frac{8}{11}$d.

C. 1. $11\frac{3}{4}\frac{3}{5}\frac{3}{6}$.
2. £11 9s. $9\frac{1}{13}$d.
3. $1\frac{3}{11}$.

D. 1. £39 1s. 3d.
2. 7·7758+
3. $\frac{8}{15}\frac{8}{15}$.

E. 1. £20 11s. 8d.
2. ·000001875.
3. 8 hr. 6 min.

F. 1. $5\frac{8}{11}$ days.
2. £294 12s. $1\frac{1}{4}$d.
3. £1 5s. $7\frac{8}{15}$d.

ADVANCED EXAMINATION.

1. $112\frac{63}{171}$.
2. £28 1s. 6·1632.
3. £44 8s. $10\frac{3}{4}$d.

STANDARD VII.

A. 1. £73 2s. 6d.
2. $4\frac{1}{2}\frac{1}{9}$ per cent.
3. $3\frac{3}{8}$ years.

B. 1. $7\frac{1}{4}$ per cent.
2. £1010.
3. $1\frac{3}{8}$ per cent. loss.

C. 1. £12675
2. $3\frac{1}{2}\frac{1}{9}$ per cent.
3. £5025 12s. 6d.

D. 1. £28 16s. $6\frac{1}{4}$d.
2. £1059 4s. $8\frac{1}{19}$d.
3. $4\frac{3}{19}$ per cent.

E. 1. £185 6s. 8·49d.
2. £2 13s. $2\frac{8}{11}$d.
3. £625.

F. 1. £743 17s. $8\frac{1}{3}$d.
2. £8 12s. $6\frac{3}{4}$d.
3. £2 17s. $0\frac{6}{7}$d.

ADVANCED EXAMINATION.

1. 529296·768 pop., and 32·324192 per cent.
2. $84\frac{1}{10}$ per cent.
3. $131\frac{23}{167}$ days.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR JULY, 1882.

STANDARD III.

1.

£	s.	d.
8,061,019	0	7½
780.416	18	8½
7,280 602	1	$10\frac{3}{4}$ = 6989.378.011f. Ans.

2. ¾d. × 140 = 105d. cost of 1 ton.
£110 5s. = 26460d. which ÷ 105 = 252 tons. Ans.

3. (96 × 150 × 24) ÷ 6 = 57600 lb. of potatoes.
57600 lb. at 1½d. = 72000d. = £300. Ans.

STANDARD IV.

1. From June 2 at 1.30 p.m. to June 26 at 7.30 p.m. is 24 days 6 hours, or 24¼ days; hence the gain is 24¼ *half* minutes = 12⅛ minutes, which added to 7·30 = 7·42⅛ p.m. Ans.

2. 2240 lb. − 12 lb. = 2228 lb. sold for every ton bought.
2228 × 5½ = 12254 lb. at 4½d. = 55143d.
2228 × 4½ = 10026 lb. at 3½d. = 35091d.
= 90234d. = £375 19s. 6d., total selling price.
And £375 19s. 6d. − £315 (300g.) = £60 19s. 6d. gain. Ans.

3. ☞ To work out this exercise at length would occupy too much space. It is given as a test of sustained mechanical accuracy. See the Answer.

STANDARD V.

1. Bringing both the weights to lbs., we have 62146 lb. and 1756 lb.; and £1 14s. 6d. = 69s., then by simple proportion expressed fractionally, we have $\frac{69s. \times 62146}{2 \times 1756}$ = $\frac{4288674}{3512}$ = 1220s. $11\frac{4}{8}\frac{3}{7}\frac{4}{6}$d. = £61 0s. $11\frac{4}{8}\frac{3}{7}\frac{4}{6}$d. Ans.

	£	s.	d.	
2. £140 12s. 6d. ÷ 150	=	18	9	cost of each cheese.
1s. 3d. by 60	=	3	15 0	(*a*) gain by wholesale.
(21s. 0d. − 18s. 9d.) × 50	=	5	12 6	
£18 15s. − £9 7s 6d. (*a*)	=	9	7 6	(*b*) ,, retailing 40 ch.
18s. 9d. × 40	=	37	10 0	prime cost of ,,
Hence £9 7s. 6d. (*b*) + £37 10s.	=	46	17 6	selling price ,,
£46 17s 6d. ÷ 40	=	1	3 5½	,, ,, 1 ,,
£1 3s. 5½ ÷ 7½d.	=	37½ b. Ans.		

	£		£	s.	d.	
3. ⅔ of £48 = 36,	which at	3s. 6d.	in the £	= 6	6 0	P. rate.
⅛ ,, 40,	,,	1s. 3d.	,, ,,	= 2	10 0	G. ,,
⅓ ,, 32,	,,	2s. 9d.	,, ,,	= 4	8 0	G.D.,,
			Rent	= 48	0 0	
			Ans.	£61	4 0	

STANDARD VI.

1. $(\frac{3}{4}$ of $5\frac{1}{3}) = (\frac{3}{4}$ of $\frac{21}{4}) = \frac{63}{16} = 3\frac{15}{16}$.
$8\frac{3}{8} + 3\frac{15}{16} = 12\frac{1}{16}$ sum, $8\frac{3}{8} - 3\frac{15}{16} = 4\frac{7}{16}$ diff.; and
$(8\frac{3}{8} \times 3\frac{15}{16}) = (\frac{67}{8} \times \frac{63}{16}) = \frac{4221}{128} = 32\frac{85}{128}$ product.
$12\frac{1}{16} + 4\frac{7}{16} + 32\frac{85}{128} = 50\frac{101}{128} = 50\frac{13}{128}$ sum of the 3 results.
$(8\frac{3}{8} \div 3\frac{15}{16}) = (\frac{67}{8} \div \frac{63}{16}) = (\frac{67}{8} \times \frac{16}{63}) = \frac{134}{63} = 2\frac{8}{63}$ quotient.
$50\frac{13}{128} = \frac{6413}{128}$, and $\frac{6413}{128} \times \frac{134}{63} = \frac{859642}{8064} = 112\frac{634}{4032}$. Ans.

2. 4·85 c. ft. × 60 × 3·2 × 180 = 167616 c. ft. = 167·616 = *thousand* c. ft., which multiplied by 3·35 = 561·5136s. £28 1s. 6·1632d. Ans.

3.
$$\frac{\text{£}18 \times 80 \times 20 \times 16 \times 12 \times 5}{30 \times 12 \times 18 \times 8 \times 12} =$$

(logs. lngth. brdth dpth. ratio)

(each pair of terms being expressed in simplest ratio)

$$\frac{\text{£}18 \times 8 \times 5 \times 8 \times 3 \times 5}{3 \times 3 \times 9 \times 2 \times 12} = \text{(when cancelled) } \frac{\text{£}400}{9}$$

= £44 8s. 10⅔d. Ans.

STANDARD VII.

10 p.c. is $\frac{1}{10}$	400000	
	40000	
8 ,, ,, $\frac{1}{100}$	440000	population in 1891
	35200	
5 ,, ,, $\frac{1}{200}$	475200	,, ,, 1901
	23760	
4 ,, ,, $\frac{1}{250}$	498960	,, ,, 1911
	19958·4	
2 ,, ,, $\frac{1}{500}$	518918·4	,, ,, 1921
	10378·368	
Ans.	529296·768	,, ,, 1931

Again,—129296·768 is the *increase* in the 50 years on 400000, that is on 4000 *hundreds;* hence 129296·768 ÷ 4000 = 32·324192 per cent. Ans.

2. 10 × 160 = 1600, 9 × 50 = 450, 8 × 20 = 160, 7 × 20 = 140, 6 × 15 = 90, 5 × 10 = 50, 4 × 5 = 20, 3 × 5 = 15, 2 × 3 = 6, and 0 × 12 (rem.) = 0. These ten numbers added together give a total of 2531 *actual* attendances out of a *possible* total of (10 × 300 =) 3000 attendances. Then 2531 ÷ 30 (the number of *hundreds* in 3000) = 84⅓ per cent. Ans.

3. £85 − £83 10s. = £1 10s. discount allowed. Working on the true principle of discount—*that the present worth if put out at interest would make what has been taken off for discount*—the question may be thus simply presented, and worked by proportion;—if £100 makes £5 interest in a year (365 days), in how many days would £83 10s. make £1 10s. interest? Bringing each of the terms of money to *half* sovereigns and cancelling we have:—

$$\frac{365\text{d.} \times 200 \times 3}{167 \times 10} = \frac{21900}{167} = 131\frac{23}{167} \text{ days. Ans.}$$

Gossip.

We gladly find a place for the following paragraph, which appeared in the *Schoolmaster* of June 17th :—

'Some five years ago a statement appeared in the columns of the *Schoolmaster* to the effect that Mr. Waugh was at that time "engaged, etc., etc." The paragraph has been recently quoted in an educational contemporary, but we now learn on the best authority that the statement was incorrect. In so far as it was in any way inaccurate we regret the appearance of the paragraph in question.'

***

Messrs. W. S. Sonnenschein and Co. announce for immediate issue a series of Code Readers, intended to meet the requirements of the new Mundella Code. They will contain original and selected passages, and short stories in prose and verse, and be fully illustrated with excellent engravings.

***

The same publishers have recently issued an edition of the Third Book (on Words) of Lock's 'Essay on the Human Understanding,' with an introduction and copious notes by Mr. F. Ryland, M.A., author of the 'Student's Manual of Psychology and Ethics.'

***

The Right Hon. John Bright, as Lord Rector of the University of Glasgow, has offered a prize of twenty-five guineas for the best essay on the 'Influence of the Italian Republics on the Civilization of Europe.' Students of the last three sessions will be entitled to compete.

***

Messrs. Cassell, Petter, Galpin and Co. announce a people's edition of the Leopold Shakspere, in ten sixpenny monthly parts. This edition is too well-known to need description, but we would point out to those of our readers who are in want of a good cheap Shakspere, one or two of its distinctive features :—the admirable *Introduction* by Mr. F. J. Furnivall, and the advantage of having the plays arranged in chronological order. The 'Two Noble Kinsmen' and 'Edward III.' are included in the Leopold edition.

***

The Day of Rest, which was, some two or three years ago, a most admirable journal for Sunday reading, but whose pages have of late been greatly disfigured by coloured illustrations, has ceased to exist in separate form, and will henceforth be incorporated with the *Sunday Magazine*.

***

Mr. Alexander Gardner has in the press a volume of *Selections from Wordsworth*, edited by Mr. J. S. Fletcher, who has written an Introductory Memoir to the chosen poems.

***

One of the most interesting books for boys ever written has just been published by Messrs. Sampson, Low and Co. It is by Mr. Richard Jeffries, the well-known author of 'The Gamekeeper at Home,' 'Wood Magic,' and other works on country life, and is entitled 'Bevis, the Story of a Boy.' No better prize for a boy could be found.

***

By the time this issue of our journal reaches the hands of our readers, many of them will be arranging their summer 'outing.' Some will doubtless seek renewed vigour under the exhilarating influence of foreign travel; others will choose a favourite watering-place on the coast; and there may be a few who, unstrung with overwork, long for the quiet repose of the country. To these latter we think we can be of some little service. We have derived so much benefit from a short stay at the Bishop's Down Grove Spa, Tunbridge Wells, that it is with unusual pleasure we mention this charming health-resort to our friends. Situate on the summit of one of the breezy

Sussex downs, it commands exceptionally fine views of the surrounding country. The grounds—sixty acres in extent—are of almost unrivalled beauty, and are alone well worth a visit. Here also may be found all the usual appointments of a good hotel. No pains have been spared to provide both for the indoor and outdoor recreation of the visitors. Who that has travelled but a little, has not unpleasant recollections of the long tedious evenings spent in hotels, when the weather has been unpropitious? At the Spa, however, the evening's entertainment is often the most enjoyable. Adjoining the drawing-room there is a delightful bijou theatre, where occasionally operas, plays, concerts, charades, and lighter entertainments are presented to the guests. During our stay we witnessed an opera—'Don Pasquale,' by the Campobello-Sinico troupe—miscellaneous concerts, a reading, and a play. In the preparation of these entertainments some one must of necessity sacrifice a large share of their own pleasure for that of the company. This was cheerfully done by Mrs. Galsworthy and family, who won golden opinions from the visitors for their ready kindness in organizing several evenings' amusements. Perhaps the most enjoyable evening was that on which the laughable farce of '*Poor Pillicoddy*' was presented. This sketch was given after only two days' preparation. Here is the cast :—

Mr. Pillicoddy ..	.. ..	Mr. Robert Hickie.
Captain O'Scuttle	.. ..	Mr. Frank Galsworthy.
Mrs. Pillicoddy	.. ..	Mrs. Galsworthy.
Mrs. O'Scuttle	.. ..	Miss Jane Dealy.
Sarah	.. ..	Miss Blanche Williams.

We must not forget to state that Miss Blanche Galsworthy ably presided at the pianoforte. These amateurs entered into their work *con amore*, and the result was a complete success, each character being much appreciated by the audience. The '*Sarah*' of Miss Blanche Williams was an admirable piece of acting. Her by-play—at once quiet, humorous, and effective—gave evidence not only of good natural ability, but of careful study. Dr. Partington, the genial physician of the establishment, appeared in a new *rôle*, that of the prompter. We offer one and all our hearty congratulations. Any friends wishing to know particulars of the 'Spa' as a health-resort can have them upon application to the secretary.

***

We hear that Miss Frost is now making arrangements to hold her examination in connection with another established Kindergarten Training College, from which certificates are issued in June, 1883. Students wishing to be prepared for this examination should enter the College, 83, Gloucester Road, South Kensington, W.

***

We have received an early copy of 'Plays and Dramatic Pieces,' by Martin Tupper. The book is handsomely bound, and forms an admirable volume for presentation. Of its merit we forbear to speak, as the author is on our staff. This is a rule, which, in the conduct of this journal, we have for some time past observed.

***

For the same reason we simply announce the publication of Mr. Joseph S. Fletcher's clearly printed and neatly bound 'Early Poems.'

***

We cut the following from our vigorous, outspoken contemporary, the *Figaro*:—

'Mr. Harry Wall could hardly have spent a very happy Sabbath. A British jury awarded him one shilling damages in two separate cases, and a British judge very justly ordered Mr. Wall to pay the costs of both sides. The last case, decided on Saturday, was one of those in which Mr. Wall has gained so unenviable a notoriety. A working-men's tea-party was given at Over Darwen, and the vicar took the chair. Eightpence was charged to non-members, and fourpence to members, for their tea. Some of the residents, and among them the schoolmaster, undertook to amuse the working-men after their temperate feast, and for this no charge was made. Among the songs was "Will-o'-the-wisp." Of course Mr. Harry Wall was down upon the schoolmaster for his miserable "penalties," and threatening letters were likewise sent to the vicar, who had been guilty of the terrible crime of listening to the song, and upon the accompanist. "Cherubino" was consulted, and on his advice the action was defended. Judge and jury marked their opinion of this wretched grabbing from the poor by casting Mr. Wall in costs. Amateurs who are threatened by Mr. Wall need, therefore, not be frightened.'

'Cherubino' is the able musical critic of the *Figaro*.

***

The lamented death of Mr. Thomas Dunman, who was so well known as a teacher of Physical Science at various institutions in London, was lately noticed in our columns. We are glad to learn that a fund is being collected for helping his widow and children. The Committee includes several members of the Council of the Working Men's College, and Mr. R. B. Litchfield, Bursar of the College (4, Bryanston Street, Portman Square), is the treasurer.

Publications Received.

Arithmetic—
(1) Leedam's Systematic Mental Arithmetic. Philip and Son.
(2) Ellery's English Arithmetical Cards. W. and R. Chambers.
(3) Allen's Taunton Arithmetical Cards. W. and R. Chambers.
(4) Leedam's Systematic Elementary Arithmetic with Answers. Philip and Son.

Ethics—
(1) Bray's Elements of Morality. Longmans, Green, and Co.

Geography—
(1) Hughes's Elementary Class-book of Modern Geography. G. Philip and Son.

Geology—
(1) Clement's Tabular View of the Geological Systems. W. S. Sonnenschein and Co.

History—
(1) Home Lesson Books to Royal History Readers. Nelson and Sons.

Kindergarten Literature—
(1) Mulley's Songs and Games for Little Ones. W. S. Sonnenschein and Co.
(2) Lewis's Songs for Little Singers. Hodder and Stoughton.

Latin—
(1) Leonard's Latin Grammar. Thomas Murby.

Miscellaneous—
(1) Higginson's Common Sense about Women. W. S. Sonnenschein and Co.
(2) Bisson's Drama as an Element of Education. Simpkin, Marshall and Co.
(3) School Examination Register. Bemrose and Sons.
(4) A.B.C. Education Code. Nelson and Sons.
(5) Key to the New Code. National Society.
(6) The Sunbeam Library. Longmans and Co.
(7) Midland Analysis and Parsing Exercise Book. Midland Educational Co.
(8) Ryland's Locke on Words. W. S. Sonnenschein and Co.

Periodical Literature—
(1) Sports and Pastimes. No. 3. Cassell, Petter, Galpin, and Co.
(2) Universal Instructor. Part 20. Ward, Lock, and Co.

Prize Books—
(1) Doudney's Michaelmas Daisy. Griffith and Farran.

Readers—
(1) Chambers' Grad. Readers I. and II. W. and R. Chambers.

Science—
(1) Watts' Science in a Nutshell. W. and A. K. Johnston.
(2) Edmonds' Elementary Botany. Longmans, Green, and Co.

Scripture—
(1) Linton's Second Epistle to the Corinthians. G. Philip and Son.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. BEDE.—A tradesman's prices are 20 per cent. above cost price. If he allow a customer 12 per cent. on his bill, what profit does he make?

Suppose cost price were £100,
Then tradesman's price would be £120;
Selling price after deducting discount = £120 − 12 % on £120
= £120 − £14$\frac{2}{5}$
= £105$\frac{3}{5}$;
∴ Profit = 5$\frac{3}{5}$ per cent. Ans.

2. E. S., Newcastle.—At a game of billiards A can give B 15 points in 50, and he can give C 20 in 50; how many can B give C in a game of 70? (Barnard Smith.)

A can give B 15 points in 50,
" " C 20 " 50;
∴ B makes 35 points, while A makes 50,
C " 30 " " A " 50;
∴ B can give C 5 points in 35,
" " C 10 " 70. Ans.

3. EYES FRONT.—On what day of the week will the 1st of January fall in 1880, in 1890, and in 1900, respectively? (*Johnston's* 'Civil Service Arithmetic.')

1st January, 1880 was on Thursday.

In the 10 years from 1st January, 1880, to 1st January, 1890, there are 3 leap years;

∴ From 1st January, 1880, to 1st January, 1890, there are 520 weeks and 13 days, that is, 521 weeks and 6 days.

∴ 1st January, 1890, will fall on Wednesday.

In the 10 years from 1st January, 1890, to 1st January, 1900, there are 2 leap years;

∴ From 1st January, 1890, to 1st January, 1900, there are 520 weeks and 12 days, that is, 521 weeks and 5 days.

∴ 1st January, 1900, will fall on Monday.

NOTE.—Queries are *not* confined to Mathematical Questions.

4. CHIMBORAZO.—In what years of the present century are there five Saturdays in February? Give reasons for your answer.

5 Saturdays in February occur in the leap year when the first of the month falls on that day.

In 4 years there are 208 weeks and 5 days;

∴ 1st February in a leap year falls two days earlier than in the previous leap year;

∴ 1st February in a leap year will fall on the same day in 4×7 or 28 years.

1st February 1880 was on Sunday;
" 1884 will fall on Friday;
" 1888 " Wednesday;
" 1892 " Monday;
" 1896 " Saturday.
∴ The years are 1896, 1868, 1840, and 1812. Ans.

5. LATIN.—A person bought a French watch, bearing a duty of 25 per cent.; and sold it at a loss of 5 per cent.; had he sold it for £3 more, he would have cleared 1 per cent. on his bargain. What had the French maker for it? (*Barnard Smith.*)

Suppose the watch cost £100;
Then cost with duty = £125.
Loss = 5 per cent. on £125 = £6 5s.;
Gain of 1 per cent. = $\frac{1}{100}$ of £125 = £1 5s.;
Difference between the two prices = £6 5s. + £1 5s.
= £7$\frac{1}{2}$.
∴ Cost of watch = £100 × $\frac{3}{7\frac{1}{2}}$
= £100 × $\frac{2}{5}$
= £40. Ans.

6. YELSERP.—A person had £10,000 in the 3 per cent. South Sea Annuities, and the government offered to give £110 bearing interest at the rate of 2$\frac{1}{2}$ per cent. for every £100 of these annuities, or to pay the £10,000 in cash on a certain day. The latter proposal was preferred, and on the money being paid it was re-invested in consols at 93. How much would he have lost in income had he accepted the first proposal, and what will he now gain by the new investment? (*Barnard Smith*)

Income in 1st case = 3% on £10,000
= £300;
" 2nd " = 2$\frac{1}{2}$% on £11,000
= £275;
" 3rd " = $\frac{3}{93}$ of £10,000
= $\frac{1}{31}$ of £10,000
= £322 11s. 7$\frac{7}{31}$d.
∴ Loss by first proposal = £300 − £275
= £25. Ans.
∴ Gain by second proposal = £322 11s. 7$\frac{7}{31}$d. − £300
= £22 11s. 7$\frac{7}{31}$d. Ans.

7. INQUIRER.—Find the true discount on £755 5s. 9d., drawn March 17th at 3 months, discounted May 31st, at 6 per cent. (*Colenso.*)

Bill is due on June 20th.
No. of days from May 31st to June 20th = 20.
Interest on £100 for 20 days = $\frac{20}{365}$ of £6
= £1$\frac{13}{73}$.

£ £ s. d. £
∴ 100¾ : 755 5 9 :: ¾ : True Discount

73 24
7324) 18126 18 0 (2£
14648
3478
20
69578 (9s.
65916
3662

∴ True Discount = £2 9s. 6d. Ans.

8. TUGELA.—Two boys A and B start together from the same point and walk round and round a ring fence in opposite directions, till they meet at the starting point; their last meeting place before this was 990 yards from it. A's rate being to B's rate as 5 : 3, find the distance covered by each.

While B walks 990 yards, A walks 990 yards × ⅝ = 1650 yards.

Distance round the fence = (990 + 1650) yards
= 2640 yards
= 1⅝ miles;

∴ Distance covered by A = (1⅝ × 5) miles = 7⅛ miles
" " B = (1⅝ × 3) " = 4⅜ " } Ans.

9. TED.—A person invests £1037 10s. in the 3 per cents. at 83, and when the funds have risen 1 per cent. he transfers his capital to the 4 per cents. at 96. Required the alteration in his income. (*Barnard Smith.*)

Stock in 1st case = £1037½ × 100/83
= £(1037½ × 50/83)
= £1250;
Income " " = 3% on £1250
= £37 10s.:
Stock in 2nd case = £1250 × 83/96
= £1250 × ⅚
= £1093¾;
Income " " = 4% on £1093¾
= £43·75
= £43 15s.:
∴ Alteration in income = £43 15s. — £37 10s.
= £6 5s. increase. Ans.

10. DONETTE.—What difference in income is made by transferring £4275 from 4 per cents. at 80 to 5½ per cents. at 90?

Income in 1st case = 4% on £4275
= £171:
Stock in 2nd case = £4275 × 80/90
= £3800;
Income " " = 5½% on £3800
= £38 × 5½
= £209:
∴ Difference in income = £209 — £171
= £38 increase. Ans.

11. FERN, Carlisle.—A company whose capital is £2,500,000 pays 6½ per cent. per annum to shareholders, clear of income tax at 4d. in the £; find total receipts, expenses being 60 per cent. of gross receipts. (*Johnston's Civil Service Arithmetic.*)

Dividend without income-tax = 6½ % on £2,500,000
= £25,000 × 6½
= £162,500;
" with " = £162,500 × £1 / 19s. 8d.
= £162,500 × 20/19
= £(2710000/19):
Expenses = 60 % or ⅗ of gross receipts;
∴ Dividend = ⅖ of gross receipts:
∴ Annual receipts = Dividend × 5/2
= £((2710000/19) × 5/2)
= £13550000/38
= £413.135 11s. 10 10/19 d. Ans.

12. P. WATTS.—If a person transfer from the 3 per cent. stock at 73¾ to the 3½ per cents. at 81½, he would increase his income £4 10s.; how much stock has he in the 3 per cents.?

Income on £100 stock in 3 per cents. = £3;
" " " " " when transferred to 3½ per cents. = £3½ × 73¾/81½
= £3½ × 295/326
= £(7/2 × 59/326)
= £3 413/652;
Increase in income = 413/652 £;
∴ Stock in 3% ... = £100 × 4½ £ / 413/652 £
= £100 × 30
= £3000 Ans.

Note.—Elliot's *Mensuration*, 2s. (Hughes.)

13.—LIOC.—I have shares amounting to ⅞ of a property worth £126 14s. 1d., and after purchasing additional shares worth ⅛ of my own, I sell 1/13 of my whole interest in the property. What share have I left, and what is it worth? Express both results in decimals.

Share left = 3/13 £ of ⅞ of 8/7
= 3/13
= ·230769. Ans.
Value = 3/13 of £126 14s. 1d.
= 1/13 of £380 2s. 3d.
= 1/13 of £380·1125
= £29·2394230769. Ans.

14. ALVESTON.—If 3 cows or 7 horses can eat the produce of a field in 29 days, in how many days will 7 cows and 3 horses eat it up? (*Barnard Smith.*)

3 cows can eat as much as 7 horses,
∴ 1 cow " " 7/3 "
7 cows " " 7/3 × 7 "
= 16⅓ "
7 cows and 3 horses " 19⅓ " :
7 horses can eat the produce of the field in 29 days,
∴ 1 horse " " " " (29 × 7) "
And 19⅓ horses " " " 29 × 7 / 19⅓ "
= 29 × 7 × 3 / 58/3 "
= 10½ days
= 10½ days. Ans.

15. ALPHA.—What must be the price of 3 per cent. stock in order that, after deducting an income-tax of 7d. in the pound, the dividend received may be equal to 3½ per cent. on the sum invested?

s. d £ s. d. £
As 19 5 : 3 6 8 :: 1 : Percentage with income-tax.

12 20
233 66
12
800
£3 146/233.

£ £ £
∴ 3 146/233 : 3 :: 100 : Price of stock
233 699
800
= 87⅜. Ans.

16. R. B.—A publisher wishes to net 14s. for each copy of a work; what price should he put upon it so as to be able to allow the trade 30 per cent. discount?

£100 − £30 = £70.
£ £ £
∴ 70 : 14 :: 10 : Selling price
2
= £1. Ans.

17. SHAWN.—The sum of two numbers is 104; ⅜ of the greater number is equal to the difference between them. Find the numbers.

As the difference between the two Nos. = ⅜ of greater No.,
∴ Lesser No. = ⅜ of greater No.

Greater No. + Lesser No. = 104
Greater No. + $\frac{5}{8}$ of greater No. = 104
$\frac{13}{8}$ of greater No. = 104
∴ Greater No. = $\frac{8}{13}$ of 104
= 64;
And lesser No. = 40. } Ans.

18. VESUVIUS.—Assuming the purchasing value of shillings, marks, and florins, to be 689 : 645 : 1345; find the loss on a draft for £100 if $\frac{1}{23}$ is paid in shillings, $\frac{1}{23}$ in marks, and the rest in florins, reckoning 20 marks and 10 florins to the pound. *Certificate Examination*, 1880.)

Part in florins = $1 - (\frac{1}{23} + \frac{1}{23})$
= $1 - \frac{390 + 341}{990}$
= $1 - \frac{731}{990}$
= $\frac{259}{990}$.
Loss per mark = $(1 - \frac{644}{689})$s. = $\frac{45}{689}$s.;
No. of marks = $\frac{1}{23}$ of 2000
= $\frac{2000}{23}$;
Loss on marks = $\left(\frac{2000}{23} \times \frac{45}{689}\right)$ s.
= $\frac{3600}{1587}$s.;
Loss per florin = $(2 - \frac{1345}{689})$s. = $(2 - 1\frac{656}{689})$s.
= $\frac{33}{689}$s.;
No. of florins = $\frac{259}{990}$ of 1000
= $\frac{25900}{99}$;
Loss on florins = $\left(\frac{25900}{99} \times \frac{33}{689}\right)$s.
= $\frac{855700}{68211}$s.;
∴ Total loss = $(\frac{3600}{1587} + \frac{855700}{68211})$s.
= $\frac{104000 + 25900}{2067}$s.
= $1\frac{25933}{2067}$s.
= £3 2s. $10\frac{934}{2067}$d. Ans.

19. CUTHBERT.—An empty cistern has two supplying pipes, A and B, and two taps, C and D. A would fill the cistern in $42\frac{1}{2}$ minutes, B in 46 minutes, and D can carry off per minute half as much again as C. After A and B, running together, have supplied a certain quantity, C is allowed to run with them, and takes 51 minutes to empty the cistern: but, had D been turned along with C, the two would only have taken $52\frac{1}{2}$ minutes to empty it. In what time would the cistern have been emptied if D had been turned on instead of C, and how much of the cistern was filled when C was set open?

Part filled by A and B in 1 min. = $\frac{2}{85} + \frac{1}{46} = \frac{92 + 85}{3910}$
= $\frac{177}{3910}$;
Part emptied by C and D ,, = $\frac{4}{51}$ of part filled + $\frac{177}{3910}$,
,, ,, C ,, = $\frac{4}{51}$,, ,, + $\frac{177}{3910}$,
∴ ,, ,, D ,, = $(\frac{4}{51} - \frac{1}{51})$ of part filled
= $\frac{204 - 23}{1173}$,, ,,
= $\frac{181}{1173}$ of part filled;

But part emptied by D in 1 min. = $\frac{3}{2}$ times part emptied by C in 1 min.;

∴ $\frac{181}{1173}$ of part filled = $\frac{3}{2}$ ($\frac{1}{51}$ of part filled + $\frac{177}{3910}$)
$\frac{181}{1173}$,, ,, = $\frac{3}{34}$,, ,, + $\frac{531}{7820}$
$(\frac{181}{1173} - \frac{3}{34})$ of part filled = $\frac{531}{7820}$
$\frac{362 - 69}{2346}$,, ,, = $\frac{531}{7820}$
$\frac{293}{2346}$,, ,, = $\frac{531}{7820}$
∴ Part filled = $\frac{531}{7820} \times \frac{2346}{293}$
= $\frac{1431}{3910}$. Ans.

Part emptied by D in 1 min. = $\frac{181}{1173}$ of $\frac{531}{2930}$
= $\frac{391}{1172130}$;

∴ If D had been turned on instead of C, the cistern would have been emptied in
$\{\frac{1431}{3910} \div (\frac{391}{1172130} - \frac{177}{3910})\}$ min.
= $(\frac{1431}{3910} \div \frac{96111 - 51861}{1145630})$ min.
= $\left(\frac{1431}{3910} \times \frac{1145630}{44250}\right)$ min.
= $\frac{2613}{250}$ min.
= $14\frac{113}{250}$ min.
= 14·076 min. Ans.

20. KIRKHAM.—A cubical space containing 941,192 cubic inches is exactly fitted by 64 cubical boxes, find the length of the side of each box. (*Scholarship*, 1876.)

Cubical content of each box = $\frac{941192}{64}$ cub. in.
= $\frac{117649}{8}$ cub. in.:
∴ Side of each box = $\sqrt[3]{\frac{117649}{8}}$ cub. in.

	117649	49
$4^2 \times 300 = 4800$	53649	
$4 \times 9 \times 30 = 1080$		
$9^2 = 81$		
5961	53649	

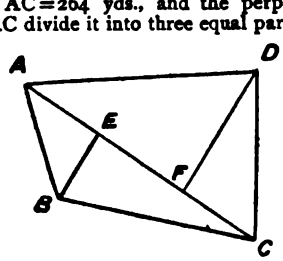
= $\frac{49}{2}$ in.
= $24\frac{1}{2}$ in. Ans.

21. MATHEMATICUS.—What sum of money must be divided among A, B, C, so that A may have 6s. and C 9s. $4\frac{1}{2}$d., and that B may have as much per cent. more than A, as C has more than B? (*Colenso.*)

B's share = A's share × $\frac{100 + \text{Percentage}}{100}$
C's share = B's share × $\frac{100 + \text{Percentage}}{100}$
= A's share × $\frac{100 + \text{Percentage}}{100} \times \frac{100 + \text{Percentage}}{100}$
= A's share × $\left(\frac{100 + \text{Percentage}}{100}\right)^2$
A's share × $\left(\frac{100 + \text{Percentage}}{100}\right)^2$ = C's share
$\left(\frac{100 + \text{Percentage}}{100}\right)^2$ = $\frac{\text{C's share}}{\text{A's share}}$
= $\frac{9\text{s. } 4\frac{1}{2}\text{d.}}{6\text{s.}}$
= $\frac{25}{16}$
∴ $\frac{100 + \text{Percentage}}{100}$ = $\sqrt{\frac{25}{16}}$
= $\frac{5}{4}$.
B's share = A's × $\frac{100 + \text{Percentage}}{100}$
= 6s. × $\frac{5}{4}$
= 7s. 6d.
∴ Sum = 6s. + 7s. 6d. + 9s. $4\frac{1}{2}$d.
= £1 2s. $10\frac{1}{2}$d. Ans.

Mensuration.

1. J. KEEFE, F.S.A.—Find the area in ac., ro., and po., of a quadrilateral ABCD from the following data:—AB = 110 yds., AD = 220 yds., AC = 264 yds., and the perpendiculars from B and D upon AC divide it into three equal parts.



AE = $\frac{1}{3}$ of AC = 88 yds.; AF = $\frac{2}{3}$ of AC = 176 yds.
$DF^2 = AD^2 - AF^2$
= $220^2 - 176^2$
= 48400 − 30976
= 17424
∴ DF = 132.

$BE^2 = AB^2 - AE^2$
$= 110^2 - 88^2$
$= 12100 - 7744$
$= 4356$
$\therefore$ BE = 66.

Area of quadrilateral ABCD $= \frac{AC \times (DF + BE)}{2}$
$= \frac{264 \times (132 + 66)}{2}$ sq. yds.
$= (132 \times 198)$ sq. yds.
$= \frac{12 \quad 18}{\not{3}\not{2} \times \not{1}\not{9}\not{8} \times 4}{\not{1}\not{1}\not{1}}$ po.
$= 864$ po.
$= 21$ ro. 24 po.
$= 5$ ac. 1 ro. 24 po. Ans.

Note.—Your solution of the Arithmetical query in our last issue is correct, but you say the difference £1 is the interest on the discount for 9 *months*, whereas it should be 1 *year*.

2. MUDDLED.—How many feet of boarding will be required for a roof 72 ft. long, and $19\frac{1}{10}$ ft. deep, the boards being 9 ft. long and $5\frac{1}{2}$ in. deep, if the longer edge of each is laid horizontally, and overlaps the lower board by $\frac{3}{4}$ of an inch? (*Scholarship*, 1879.)

Quantity of boarding $= 72$ ft. $\times 19\frac{1}{10}$ ft. $\div (5\frac{1}{2}$ in. $- \frac{3}{4}$ in.)
$= \left(\frac{\not{7}\not{2}}{1} \times \frac{305}{\not{1}\not{0}}\right)$ sq. ft. $\div 4\frac{3}{4}$ in.
$= \frac{2}{2744}$ sq. ft. $\div \frac{19}{4}$ ft.
$= \left(\frac{2745}{\not{2}} \times \frac{\not{4}\not{8}}{19}\right)$ ft.
$= \frac{25920}{10}$ ft.
$= 3,467\frac{7}{10}$ ft.; or,
$(3,467\frac{7}{10} \div 9) = 385\frac{7}{10}$ pieces 9 ft. long.

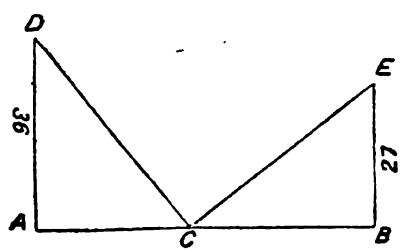
3. T. H. WILLIAM.—Find the content of a ring whose section is 9 inches square, and outside diameter 6 feet.

Inside diameter $= 6$ ft. $- 9$ in. $= 5$ ft. 3 in.
Content of ring $= [\{(6)^2 - (5\frac{1}{4})^2\} \times \cdot 7854]$ sq. ft. $\times 9$ in.
$= \{(6 + 5\frac{1}{4}) \times (6 - 5\frac{1}{4}) \times \cdot 7854 \times \frac{3}{4}\}$ cub. ft.
$= (11\frac{1}{4} \times \frac{3}{4} \times \cdot 7854 \times \frac{3}{4})$ cub. ft.
$= \left(\frac{\not{4}\not{5}}{4} \times \frac{3}{4} \times \frac{3927}{\not{1}\not{0}\not{0}\not{0}} \times \frac{3}{4}\right)$,,
$= \frac{1}{1000}$ cub. ft.
$= 4\frac{27}{1000}$ cub. ft.
$= 4$ cub. ft. 1,676·349 in. Ans.

4. ALASCO.—The difference between the areas of two squares inscribed and circumscribed about a circle is 338 sq. ft. Find the radius of the circle.

Circumscribed square is double inscribed square.
$\therefore$ Area of circumscribed square $= (338 \times 2)$ sq. ft.
$= 676$ sq. ft.
But ,, ,, $=$ Diameter^2;
$\therefore$ Diameter$^2 = 676$ sq. ft.
Diameter $= \sqrt{676}$ sq. ft.
$= 26$ ft.
$\therefore$ Radius $= 13$ ft. Ans.

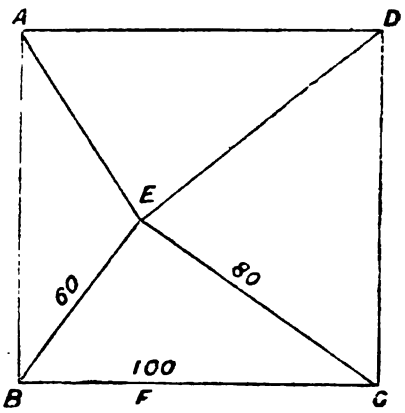
5. ALBION.—A ladder, whose foot rests in a given position, just reaches a window on one side of a street, and when turned about, its foot just reaches a window on the other side. If the two positions of the ladder be at right angles to each other, and the heights of the windows be 36 and 27 feet respectively, find the width of the street and the length of the ladder.



The angles ACD, ADC are together equal to a right angle; (I. 32.)
the angles ACD, BCE are together equal to a right angle; (I. 13.)
$\therefore$ The angle ADC = the angle BCE:
In the triangle ADC, CBE,
the angles CAD, ADC = the angles EBC, BCE,
and the side CD = side CE;
$\therefore$ AC = BE, and AD = CB: (I. 26.)
$\therefore$ AC = 27, and CB = 36;
$\therefore$ Width of street $= (27 + 36)$ ft. $= 63$ ft. Ans.

$CD^2 = AD^2 + AC^2$ (I. 47)
$= 36^2 + 27^2$
$= 1296 + 729$
$= 2025$
$\therefore$ CD $= \sqrt{2025}$
$= 45$.
$\therefore$ Length of ladder $= 45$ ft. Ans.

6. FOLKESTONIAN.—The side of a square is 100 feet; a point is taken inside the square which is distant 60 feet and 80 feet respectively from the two ends of a side; find the areas of the four triangles formed by joining the point to the four corners of the square. (Todhunter's Mensuration.)



$EF^2 = BE^2 - BF^2 = 60^2 - BF^2$, (I. 47.)
And $EF^2 = CE^2 - CF^2 = 80^2 - CF^2 = 80^2 - (100 - BF)^2$
$= 6400 - 10000 + 200\ BF - BF^2$
$= 200\ BF - BF^2 - 3600$;
$\therefore\ 200\ BF - BF^2 - 3600 = 3600 - BF^2$ (Ax. 1.)
$200\ BF = 7200$
$\therefore$ BF = 36.
$EF^2 = 60^2 - BF^2 = 60^2 - 36^2 = 3600 - 1296$
$= 2304$
$\therefore$ EF $= \sqrt{2304} = 48$.

Area of triangle BEC $= \frac{BC \times EF}{2} = \left(\frac{100 \times 48}{2}\right)$ sq. ft.
$= 2400$ sq. ft.;
,, ,, ,, AED $= \frac{1}{2}$ area of square − area of triangle BEC
$= (5000 - 2400)$ sq. ft.
$= 2600$ sq. ft.;
,, ,, ,, AEB $= \frac{AB \times BF}{2} = \frac{100 \times 36}{2}$ sq. ft.
$= 1800$ sq. ft.;
,, ,, ,, CED $= (5000 - 1800)$ sq. ft.
$= 3200$ sq. ft. Ans.

Algebra.

1. T. D.—Find a number, such, that whether it be divided into 2 or 3 equal parts, the continued product of the parts is the same.

Let $x =$ the no.;
Then $\frac{x}{2} \times \frac{x}{2} = \frac{x}{3} \times \frac{x}{3} \times \frac{x}{3}$
$\frac{x^2}{4} = \frac{x^3}{27}$
Dividing by x^2 $\frac{1}{4} = \frac{x}{27}$
$\therefore\ x = \frac{27}{4}$
$= 6\frac{3}{4}$.

2. IN A FIX.—Solve the equation :—$5x^3 - 56 = 6x^{\frac{3}{2}}$.

$$5x^3 - 56 = 6x^{\frac{3}{2}}$$
$$5x^3 - 6x^{\frac{3}{2}} = 56$$
$$x^3 - \tfrac{6}{5}x^{\frac{3}{2}} = \tfrac{56}{5}$$
$$x^3 - \tfrac{6}{5}x^{\frac{3}{2}} + (\tfrac{3}{5})^2 = \tfrac{56}{5} + \tfrac{9}{25}$$
$$= \tfrac{289}{25}$$
$$x^{\frac{3}{2}} - \tfrac{3}{5} = \pm \tfrac{17}{5}$$
$$x^{\frac{3}{2}} = \pm \tfrac{17}{5} + \tfrac{3}{5}$$
$$= 4 \text{ or } -\tfrac{14}{5}$$
$$x^3 = 16 \text{ or } \tfrac{196}{25}$$
$$\therefore x = \sqrt[3]{16} \text{ or } \sqrt[3]{\tfrac{196}{25}}$$
$$= 2\sqrt[3]{2} \text{ or } \tfrac{14}{5}\sqrt[3]{\tfrac{2}{25}}.$$

3. AGIER.—Find a, b, c so that each of the two following expressions may be perfect squares:—$x^4 + ax^3 + bx^2 + cx + 1$ and $x^4 + 2ax^3 + 2bx^2 + 2cx + 1$. (*Intermediate Arts, London University*, 1881.)

$x^4 + ax^3 + bx^2 + cx + 1 \Big(x^2 + \frac{a}{2}x + 1$

x^4

$2x^2 + \frac{a}{2}x \;\Big|\; ax^3 + bx^2$

$ax^3 + \frac{a^2}{4}x^2$

$2x^2 + ax + 1 \;\Big|\; \left(b - \frac{a^2}{4}\right)x^2 + cx + 1$

$2x^2 + ax + 1$

$\therefore b - \frac{a^2}{4} = 2$, and $c = a$.

$x^4 + 2ax^3 + 2bx^2 + 2cx + 1 (x^2 + ax + 1$

x^4

$2x^2 + ax \;\Big|\; 2ax^3 + 2bx^2$

$2ax^3 + a^2x^2$

$2x^2 + 2ax + 1 \;\Big|\; (2b - a^2)x^2 + 2cx + 1$

$2x^2 + 2ax + 1$

$\therefore 2b - a^2 = 2$, and $2c = 2a$.

$b - \frac{a^2}{4} = 2$
$2b - a^2 = 2$
$4b - a^2 = 8$
$2b - a^2 = 2$
$2b = 6$
$\therefore b = 3.$

$2b - a^2 = 2$
$6 - a^2 = 2$
$a^2 = 4$
$\therefore a = 2$
$c = a = 2$

$\therefore a = 2,\ b = 3,\ c = 2.$ Ans.

Note.—We have not received any other queries from you.

4. DOMINICA.—A train, an hour after starting, meets with an accident which detains it an hour, after which it proceeds at $\frac{5}{6}$ of its former rate, and arrives 3 hours behind time; but had the accident happened 50 miles farther on the line, it would have arrived an hour and twenty minutes sooner. Find length of line.

Let x = length of line in miles,
And y = original rate of train per hour in miles;
Then $x - y$ = distance left after accident,
And $\frac{x-y}{\frac{5}{6}y}$ = no. of hrs. required to travel this distance.

$$\therefore 2 + \frac{x-y}{\frac{5}{6}y} = \frac{x}{y} + 3. \quad (1)$$

If the accident had happened 50 miles further on,
Then $1 + \frac{50}{y}$ = no. of hrs. before accident,
And $x - y - 50$ = distance left after accident.

$$\therefore 2 + \frac{50}{y} + \frac{x-y-50}{\frac{5}{6}y} = \frac{x}{y} + 3 - 1\tfrac{1}{3}. \quad (2)$$

Multiplying by $3y$:
(1) $6y + 5(x - y) = 3x + 9y$
(2) $6y + 150 + 5(x - y - 50) = 3x + 5y$

(1) $6y + 5x - 5y = 3x + 9y$
(2) $6y + 150 + 5x - 5y - 250 = 3x + 5y$
(1) $2x - 8y = 0$
(2) $2x - 4y = 100$
(1) $x - 4y = 0$
(2) $2x - 4y = 100$
$\therefore x = 100$

$\therefore$ Length of line = 100 miles. Ans.

Note.—Writing *very good*.

5. NIL DESPERANDUM.—A cistern can be filled in 15 minutes by two pipes, A and B, running together; after A has been running by itself for 5 minutes, B is also turned on, and the cistern is filled in 13 minutes more. In what time would it be filled by each pipe separately? (*Colenso's Algebra*.)

Let x = no. of min. it takes A to fill the cistern,

Then $\frac{1}{x}$ = part filled by A in 1 min.;

$$\therefore \frac{5}{x} + \frac{13}{15} = 1$$
$$\frac{5}{x} = 1 - \tfrac{13}{15}$$
$$= \tfrac{2}{15}$$
$$2x = 75$$
$$\therefore x = 37\tfrac{1}{2}$$

Part filled by B in 1 min. $= \frac{1}{15} - \frac{1}{x} = \frac{1}{15} - \frac{2}{75} = \frac{1}{25}$.

$\therefore$ A could fill the cistern in $37\frac{1}{2}$ min. and B in 25 min. Ans.

6. MOEL FAMMAN.—A and B exchange purses; A has as many half-sovereigns as B has half-crowns, and as many sixpences as B as shillings; find the ratio of the number of half-sovereigns to the number of sixpences, so that neither may lose by the exchange. (*Scholarship*, 1877.)

Let x = no. of half-sovereigns in A's purse,
And y = „ sixpences in A's purse;
Then $20x + 2y$ = value of the money in A's purse in sixpences,
And $5x + 2y$ = „ „ B's „ „ „;

$$\therefore 20x + y = 5x + 2y$$
$$20x - 5x = 2y - y$$
$$15x = y.$$

$\therefore$ The number of half-sovereigns is to the number of sixpences in the ratio of 1 to 15. Ans.

7. JUNIOR.—Find x from the following equation:—

$$\left(a^{\frac{1}{2}} + x^{\frac{1}{2}}\right)^{\frac{1}{3}} = \left(a^{\frac{1}{3}} + x^{\frac{1}{3}}\right)^{\frac{1}{2}}.$$
$$\left(a^{\frac{1}{3}} + x^{\frac{1}{2}}\right)^{\frac{1}{3}} = \left(a^{\frac{1}{2}} + x^{\frac{1}{3}}\right)^{\frac{1}{2}}$$

Raise both sides to the sixth power:
$$\left(a^{\frac{1}{3}} + x^{\frac{1}{2}}\right)^2 = \left(a^{\frac{1}{2}} + x^{\frac{1}{3}}\right)^3$$
$$a + 2a^{\frac{1}{3}}x^{\frac{1}{2}} + x = a + 3a^{\frac{2}{3}}x^{\frac{1}{2}} + 3a^{\frac{1}{3}}x^{\frac{2}{3}} + x$$
$$2a^{\frac{1}{3}}x^{\frac{1}{2}} = 3a^{\frac{2}{3}}x^{\frac{1}{2}} + 3a^{\frac{1}{3}}x^{\frac{2}{3}}$$

This is satisfied by $x = 0$.

Divide each side by $a^{\frac{1}{3}}x^{\frac{1}{2}}$:
$$2a^{\frac{1}{6}}x^{\frac{1}{6}} = 3a^{\frac{1}{3}} + 3x^{\frac{1}{3}}$$
$$3x^{\frac{1}{3}} - 2a^{\frac{1}{6}}x^{\frac{1}{6}} = -3a^{\frac{1}{3}}$$
$$x^{\frac{1}{3}} - \frac{2a^{\frac{1}{6}}x^{\frac{1}{6}}}{3} = -a^{\frac{1}{3}}$$
$$x^{\frac{1}{3}} - \frac{2a^{\frac{1}{6}}x^{\frac{1}{6}}}{3} + \left(\frac{a^{\frac{1}{6}}}{3}\right)^2 = -a^{\frac{1}{3}} + \frac{a^{\frac{1}{3}}}{9}$$
$$= -\frac{8a^{\frac{1}{3}}}{9}$$
$$x^{\frac{1}{6}} - \frac{a^{\frac{1}{6}}}{3} = \pm\frac{a^{\frac{1}{6}}\sqrt{-8}}{3}$$
$$x^{\frac{1}{6}} = \frac{a^{\frac{1}{6}}\left(1 \pm \sqrt{-8}\right)}{3}$$
$$\therefore x = \frac{a\left(1 \pm \sqrt{-8}\right)^6}{3^6}, \text{ or } 0.$$

8. J. EDWARDS, Burton-on-Trent.—A flock of 37 sheep (wethers and ewes) was sold for £89 1s., a ewe fetching $\frac{3}{5}$ of the price of a wether. Altogether the ewes fetched £4 11s. more than the wethers. How many wethers were there, and what did each sell for?

Amount for wethers = $\frac{1}{2}$ of (£89 1s. − £4 11s.)
= $\frac{1}{2}$ of £84 10s.
= £42 5s.;
And „ ewes = £42 5s. + £4 11s.
= £46 16s.

Let x = price of a wether in shillings,
Then $\frac{3x}{5}$ = „ „ ewe „ „ ;

$\therefore$ £42 5s. $\div x$ or $\frac{845}{x}$ = No. of wethers,

And £46 16s. $\div \frac{3x}{5}$ or $\frac{1560}{x}$ = „ ewes;

$$\therefore \frac{845}{x} + \frac{1560}{x} = 37$$

$$2405 = 37x$$

$$\therefore x = 65.$$

$\therefore$ Price of a wether = 65s. = £3 5s.; No. of wethers = $\frac{845}{65}$ = 13. } Ans.

9. WINTON.—From each of a number of foreign gold coins a person filed a fifth part, and had passed $\frac{4}{5}$ of them, gaining thereby 52s. 6d., when the rest were seized as light coin, except one with which the man decamped, having lost upon the whole $\frac{1}{8}$ as much as he had gained before: how many coins were there at first? (Colenso.)

First Method.

Gain on $\frac{4}{5}$ of the coins = 52s. 6d.,
„ all „ „ = 52s. 6d. $\times \frac{5}{4}$
= £4$\frac{1}{8}$;
$\therefore$ Value of the coins = £4$\frac{1}{8} \times 5$
= £$\frac{175}{8}$.

Let x = No. of coins;

Then $\frac{175}{8x}$ = value of each coin in pounds,

And $\frac{1}{8}$ of $\frac{175}{8x}$ or $\frac{35}{2x}$ = loss on each coin seized;

Loss on the coins seized = 52s. 6d. + $\frac{1}{8}$ of 52s. 6d.
= $\frac{7}{8}$ of £2$\frac{1}{8}$
= $\left(\frac{7}{8} \text{ of } \frac{17}{8}\right)$ £
= £$\frac{119}{64}$.

$$\therefore \left(\frac{2x}{5} - 1\right) \times \frac{35}{2x} = \frac{119}{64}$$

$$\frac{2x-5}{5} \times \frac{5}{x} = \frac{7}{4}$$

$$\frac{2x-5}{x} = \frac{7}{4}$$

$$8x - 20 = 7x$$

$$8x - 7x = 20$$

$$\therefore x = 20$$

$\therefore$ No. of coins = 20. Ans.

Second Method.

Gain on each coin passed = $\frac{1}{5}$ of its value,
Loss „ seized = $\frac{1}{8}$ „ „

$$\therefore \left(\frac{2x}{5} - 1\right) \times \frac{1}{8} = \frac{7}{8} \text{ of } \frac{7x}{5} \times \frac{1}{4}$$

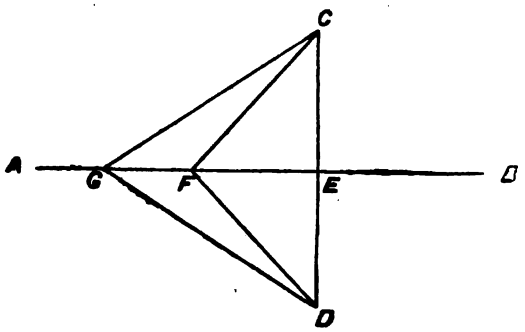
$$\frac{4(2x-5)}{25} = \frac{7x}{25}$$

$$8x - 20 = 7x$$

$$\therefore x = 20.$$

Geometry.

1. O. H. F.—From every point of a given line, the lines drawn to each of two given points on opposite sides of the line are equal. Prove that the line joining the given points will be bisected by the given line at right angles.



Let AB be the given line, and C, D the given points. Draw the lines FC, FD, GC, GD, from any two points F, C in AB, and join CD.

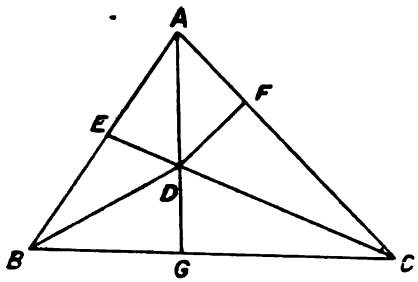
Then, if FC be equal to FD, and GC equal to GD, CD will be bisected at right angles by AB.

Proof.—In the triangles CGF, DGF,
the sides CG, GF = the sides DG, GF, each to each,
and the base CF = the base DF,
$\therefore$ $\angle$CGF = $\angle$DGF. (I. 8.)

Again, in the triangles CGE, DGE,
the sides CG, GE = the sides DG, GE, each to each,
and the $\angle$CGE = the $\angle$DGE;
$\therefore$ the base CE = the base DE, (I. 4.)
and $\angle$CEG = $\angle$DEG;
and these are adjacent angles;
$\therefore$ AB is at right angles to CD. (Def. 10.)

Wherefore CD is bisected at right angles by AB.—Q.E.D.

2. BINK.—Show that the lines bisecting the angles of any triangle meet in a point.



Let ABC be a triangle, then the lines bisecting the angles will will meet in a point.

Bisect the angles ABC, ACB by straight lines meeting in D (I. 9), join AD.

Then AD shall bisect the angle BAC.

Draw DE, DF, DG perpendicular to AB, AC, BC, respectively. (I. 12.)

Proof.—In the triangles BDE, BDG,
the $\angle$DBE = the $\angle$DBG, (Hyp.)
the $\angle$DEB = the $\angle$DGB, (Ax. 11,)
and the side BD is common to the two triangles.
$\therefore$ side DE = side DG. (I. 26.)

Similarly it can be proved that DF = DG.

$\therefore$ DE = DF. (Ax. 1.)

Again, $AD^2 = DE^2 + AE^2$, (I. 47.)
and $AD^2 = DF^2 + AF^2$;
but DE = DF;
$\therefore$ AE = AF.

In the triangles EAD, FAD,
the sides EA, AD = the sides FA, AD, each to each,
and the base ED = the base FD,
$\therefore$ $\angle$EAD = $\angle$FAD. (I. 8.)

Wherefore the lines bisecting the angles of the triangle meet in a point.—Q.E.D.

General.

1. L. M. N.—Write to the Civil Service Commissioners, Cannon Row, S.W., who will give you the necessary information.

2. STUDENT, Newcastle.—Apply to Messrs. W. and R. Chambers, Edinburgh.

3. WALLACE.—Writing very good.

4. STUDENT, Leicester.—Apply to the Principal of the College.

5. Ex. P. T.—*Amner's* 'Notes of Lessons and How to Write Them,' 2s. 6d. (Moffatt and Paige).

6. THE MOLE.—Four forces, 20, 20, 10, and 10, act upon a point; the angle between the first and second is 45°, the angle

between the second and third is 75°, and the angle between the third and fourth is 120°; find the resultant.—(*Neuth's* 'Smaller Natural Philosophy.')

The resultant of the first and second forces bisects the angle between them (as the forces are equal) and

$$= 2 \times 20 \cos 45\tfrac{1}{2}^\circ$$
$$= 40 \cos 22\tfrac{1}{2}^\circ$$
$$= 40 \times \cdot 9238795$$
$$= 36\cdot 95518.$$

The resultant of the third and fourth forces bisects the angle between them and

$$= 2 \times 10 \cos 120^\circ$$
$$= 20 \cos 60^\circ$$
$$= 20 \times \tfrac{1}{2}$$
$$= 10.$$

∴ The resultant of the four forces

$$= \sqrt{\{(36\cdot 95518)^2 + (10)^2 + 2 \times 36\cdot 95518 \times 10 \cos (22\tfrac{1}{2}^\circ + 75^\circ + 60^\circ)\}}$$
$$= \sqrt{(1365\cdot 6853288324 + 100 + 739\cdot 1036 \cos 157\tfrac{1}{2}^\circ)}$$
$$= \sqrt{(1465\cdot 6853288324 - 739\cdot 1036 \cos 22\tfrac{1}{2}^\circ)}$$
$$= \sqrt{(1465\cdot 6853288324 - 739\cdot 1036 \times \cdot 9238795)}$$
$$= \sqrt{(1465\cdot 6853288324 - 682\cdot 8426644162)}$$
$$= \sqrt{782\cdot 8426644162}$$
$$= 27\cdot 97932 \ldots \text{Ans.}$$

7. W. R., Kirkcaldy.—Any text-book on Trigonometry will give you the proof of $\sin (A+B) = \sin A \cos B + \cos A \sin B$.

Deduce that $2 \sin A \sin B = \cos (A-B) - \cos (A+B)$.

$$\cos (A-B) - \cos (A+B) = \cos A \cos B + \sin A \sin B - (\cos A \cos B - \sin A \sin B)$$
$$= \cos A \cos B + \sin A \sin B - \cos A \cos B + 2 \sin A \sin B$$
$$= 2 \sin A \sin B.$$

8. T. H. B.—As you say, the question is more algebraical than arithmetical. We do not think there is a simpler arithmetical solution. Your writing is very good indeed.

9. SUBSCRIBER.—Angus (*Religious Tract Society*), or Morris (*Macmillan and Co.*)

10. NESTA.—Yes.

11. LOL.—The Civil Service Commissioners, Cannon Row, S.W., will give *all* information required.

12. R. S.—(*a*) *Blackiston's* 'The Teacher': Hints on School Management, 2s. 6d. (Macmillan and Co.); *Gill's* 'Text Book on School Management,' 3s. (Longmans). (*b*) Scholarship and Certificate (First Year), 2 Books of Euclid; Certificate (Second Year), 4 Books.

13. W. E. EDWARDS.—Two solutions of your query were given in our issue for May. There is no arithmetical solution to the problem, and therefore the question ought not to be given in an arithmetical book.

14. EARNEST. — *Todhunter's* 'Mechanics for Beginners,' 4s. 6d. (Macmillan and Co.); *Elliott's* 'Mensuration,' 2s. (Hughes); Physics, *Ealfour Stewart's* 'Elementary Physics,' 4s. 6d. (Macmillan).

15. SAM WELLER.—(*a*) Any time. (*b*) Civil Service Commissioners, Cannon Row, S.W.

16. PRECEPTOR.—The question, as you say, is worded very loosely. The great objection to parsing as commonly employed is that the pupil is apt, from the individual consideration he gives each word, to lose sight of the structure of the sentence as a whole, and the logical continuity of its parts. To prevent this, it is advisable that the pupil should be taught the leading facts concerning the Subject and Predicate, as soon as ever he has mastered the first elementary notions and definitions of Grammar. After being led to remark what kinds of words occur in the Subject, and what in the Predicate and its enlargements, he will feel more at home, as it were, in the *sentence*, and will have his interest and attention quickened in a study, which would otherwise appear dry and unprofitable.

17. AMATEUR.—Your suggestion shall be considered.

18. W. R.—*Hamblin Smith's* 'Elements of Geometry,' 3s. 6d. (Rivington). *Prof. Elliot's* 'Mensuration,' 2s. (Hughes). *Hamblin Smith's* 'Trigonometry,' 4s. 6d. (Rivington), or *Todhunter's*, 5s. (Macmillan). *Gray's* 'Poems,' edited by Francis Storr, M.A., 1s. (Rivington). *Hunter's* 'Richard III.,' 1s. (Longman's), or *Aldis Wright's*, 2s. 6d. (Clarendon Press.) *Xenophon's* 'Hellenica,' edited by H. Hailstone, B.A., 4s. 6d. (Macmillan.) We do not know of any newer edition of *Cicero's* 'De Finibus' than the one issued by Messrs. Rivington in *Arnold's* 'School Classics,' price 5s. 6d. The Cambridge University Press have one in hand, but we do not think it has yet appeared.

19. SEMPER FIDELIS.—

Sentence.	Kind.	Subject with Enlargements.	Verb.	Object with enlargements.	Extension of Predicate.	Connectives.
I. And should I leave behind The inviolate island of the sage and free	Subordinate sentence, Adverbial to VI.	I	should leave	The inviolate island of the sage and free	behind	And (if)
II. And seek me out a home by a remoter sea	,,	I	(should) seek	me (*indirect*) a home	by a remoter sea	and (if)
III. Perhaps I loved it well.	Sentence parenthetically inserted	I	loved	it	well Perhaps	
IV. And should I lay my ashes in a soil which is not mine,	Subordinate sentence, Adverbial to VI.	I	should lay	my ashes	in a soil *which is not mine*	and (if)
V. Which is not mine	Subordinate sentence, Adjectival to SOIL in IV.	which	is	not mine		
VI. My spirit shall resume it.	Princ. sent.	My spirit	shall resume	it		
VII. if we may Unbodied choose a sanctuary.	Subordinate sentence, Adverbial to VI.	we unbodied	may choose	a sanctuary		if

20. UTOR NON ABUTOR.—Every word in a statement should admit of one construction, and *only* one. It is in this respect, we think, the sentence you send is faulty. If the words '*in writing, and speaking*' are inserted after the word '*expression*,' there will be a considerable gain in perspicuity and accuracy.

21. ACHATES.—*Forasmuch as*, a conjunctional phrase almost equivalent to *because*.

Then, Adverb. *What*, Interrogative Pronoun used adjectively, qualifying '*thing*' or '*manner of man*,' understood. *As*, a Conjunctive Adverb: (it might, without much error be classed as a preposition, equivalent to '*like to*,' and governing *Barnabas*.)

It, Personal Pronoun, Neuter Nominative to Verb. *came to pass*, used pleonastically (*i.e.* superfluously) for the sentence 'they went both together, etc.,' which is the real subject to the verb 'came to pass.'

That, a Subordinative Conjunction, joining the Sentences 'they went both,' etc., and 'It came to pass in Iconium.'

Both, Adjective, qualifying *men* understood.

Also, Adverb.

22. J. PRICE.—*Mrs. Wigley's* 'How I Teach Domestic Economy,' now appearing in the 'GOVERNESS,' will exactly meet your requirements.

23. R. P.—From the Civil Service Commissioners, Cannon Row, S.W.

24. J. GUILD.—(1) The National Society publish a good text-book on Botany. (2) Murray.

25. PUPIL TEACHER.—We cannot give you the necessary informa ion.

26. J. W. BRAY.—The books you mention, with the one you already have, should enable you to pass well.

27. J. L. GIBSON.—It may be possible to solve your query, but the solution would be very difficult.

28. SYDNEY.—You must have the segments of the disgonal E B for the solution of your query.

29. E. CROSS.—If equal weights of two substances of different temperatures have, when mixed, a resulting temperature, which is a mean between the two, show that the specific heats of the substances are equal. (Newth.)

As the resulting temperature is a mean between the temperatures of the two substances, the heat lost by one substance is exactly gained by the other substance, and therefore their specific heats are equal.

30. A. P. T., Worthing.—Candidates have to read and sing at the *Scholarship Examination*, and have to provide themselves with writing materials, with the exception of paper.

31. ILFORD.—(1) After the second examination in that school if at least fifteen months' service and inspector's report favourable. (2) Second. (3) Only by examination. (4) No. (5) Number actually present at any attendance.

32. J. JEFFREY.—Get full syllabus for type of questions, price 6d. The papers are the same for acting teachers as for students.

33. PRECEPTOR.—A perusal of the series of articles on the 'Disciplines of the Mind,' which is now appearing in the 'GOVERNESS,' will enable you to answer the question.

34. H. DUETRAM.—Apply to Mr. Thomas Murby, 23, Bouverie Street, who publishes a good work on the subject; or to Messrs. Longman for *Sutton's Manual*.

35. EX. P. T. STRANRAER.—Yes.

36. T. C., Walham Green.—*Agier* is simply the old form of *agi*, the passive infinitive of *ago*, and the phrase you quote means, '*to be carried out honestly amongst good men.*'

Eos hortatur ut secum copias jungant, dicens, tamen, se solum acturum esse, si timeant.

37. EYES FRONT.—

Colorem—Noun, 3rd dec., from *color, coloris*, masc., sing., acc., governed by *adhibeamus*.

Tegendis—Verb, from *tego, texi, tectum, tegere*, 3rd conj., fut. part. pass., plur., dat., neut., agreeing with *iis*.

Dissimulandis—parsed in a similar manner.

Adhibeamus—Verb from *adhibeo, bui, bitum*, 2nd conj., active, subj., pres., 1st pers. plur., agreeing with its subject *nos* understood.

Verum—Conjunction.

Quot-quot—Indeclinable adj., qualifying *ea*.

Ea—Pronoun, from *is, ea, id*, neut., plur. (*referring to peccata*), and nom. case to verb *sunt*.

Demisso—Perf. part. pass., from *demitto—misi—missum*, 3rd conj., neut., sing., ablative, agreeing with *corde*.

Obsequenti—Pres. part. of *obsequor, secutus sum*. Ablative, sing., neut., agreeing with *corde*.

Quo—Conjunction.

Veniam—Noun, from *venia, veniæ*, 1st dec., fem., sing., acc., governed by *consequamur*.

Consequamur—Verb deponent, from *consequor, consecutus sum*, 3rd conj., subj., pres., 1st per. plur., to agree with its subject *nos* understood

Training Colleges.

GENERAL EXAMINATION, 1881.

FIRST YEAR.

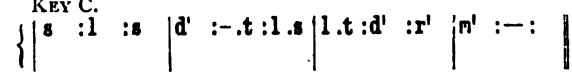
MALE AND FEMALE CANDIDATES.

Music *(continued)*

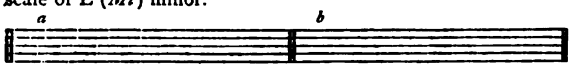
The Tonic Sol-fa questions are printed in Italic. Candidates must keep *entirely* to one set of questions or the other. *You are not permitted to answer more than* NINE *questions.*

5. *Make what alteration is required, so that the following shall appear in six-pulse measure.*

KEY C.

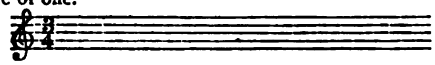


6. Write in *a* the descending, and in *b* the ascending, diatonic scale of E (*Mi*) minor.



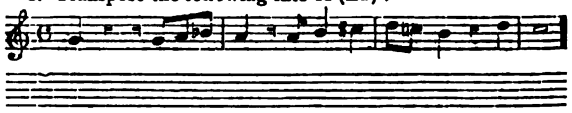
6. *Write scales in the minor modes of* RAY *and* ME, *and point out the difference between them.*

7. What is a triplet? Include in a measure of $\frac{3}{4}$ time an example of one.



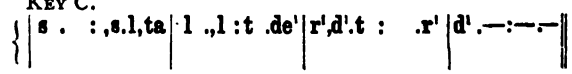
7. *What is a triplet? Write a measure of time which shall include one.*

8. Transpose the following into A (*La*) :—

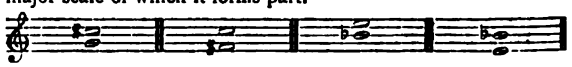


8. *Transpose the following into A* (Lah) :—

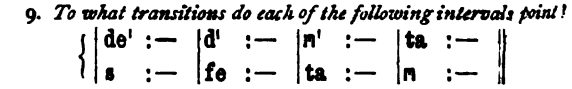
KEY C.



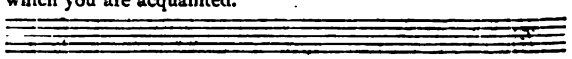
9. Write over each of the following intervals the name of the major scale of which it forms part.



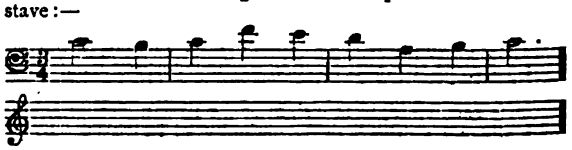
9. *To what transitions do each of the following intervals point?*



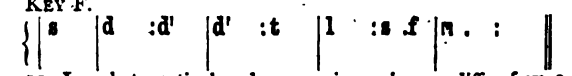
10. Write the upper tetrachord of C minor in every form with which you are acquainted.



10. *Write the upper tetrachord of the minor mode in every form with which you are acquainted.*

11. Write the following at the same pitch on the Treble stave :—

11. *Make the following an octave lower :—*

KEY F.



12. In what particular does a minor always differ from a major scale?

12. *In what particular does a minor always differ from a major scale?*

(To be continued.)

The Practical Teacher.

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Monthly Notes.

THE GENERAL ASSOCIATION OF CHURCH SCHOOL MANAGERS AND TEACHERS.—The tenth annual congress of the Church School Managers' and Teachers' Association was held in the Shire Hall, Gloucester, on the 1st and 2nd June, 1882. The proceedings commenced on the first day at a quarter to four in the afternoon, the Lord Bishop of Gloucester and Bristol presiding over a large meeting. Among those present were the Rev. Archdeacon Sheringham, Canon Gregory, Canon Spence, M. A. Nisbet, J. R. King, H. W. Maddy, B. St. John Ackers, Esq., H. D. Skrine, Esq., etc. The annual report and balance sheet having been taken as read and adopted, and a suggestion as to next year's place of meeting postponed till the following day, the Lord Bishop of Gloucester and Bristol proceeded to deliver his inaugural address. His lordship said:—

'I now at once address myself to the duty which you have kindly assigned to me of opening the Congress with a few introductory, or, as Mr. E. A. Freeman vigorously entreats us all never to say, "inaugural," words. Well, be the words introductory or inaugural, they may well be, in the main, words of sincere congratulation. In the first place, such an assembly as the present of united managers and teachers may rightly give us encouragement, and make us rejoice that common interests and a common and blessed work are bringing each year into closer and more cordial relations the managers of our church schools and that important body of Christian men on whom so much depends, both in the present and in the future—the teachers in our church schools, the makers of our future England (to use the recent words of Mr. Mundella) in the best and most pertinent sense of the words. There was a time, and that not very distant, when the close union of interests between managers and teachers was very imperfectly recognised; nay, even now, as I shall have hereafter to remark, co-operation may, in many cases, be more hearty and effective. There was once some cause for fear lest teachers should form, as it were, a separate corporation, and, to the great detriment of Christian education, should gradually segregate themselves in aims and interests from that body of men to whom our mother country owes a lasting debt of gratitude—the managers and chief supporters of our elementary Church schools. It is now, thank God, seen with increasing clearness that teachers and managers have a union, or rather, identity, of interests, which it would be simply suicidal for either party to attempt to disavow. Both have the one great and common object—the maintenance of religious teaching; both must have at heart the steady improvement and increasing efficiency of the school which is their common care; both practically find themselves to be united and one when relations with the Privy Council, hopes of new adjustment, or fears of New Codes remind them of the true nature and reality of their union. These things are now seen for the most part more clearly on both sides: and it is to meetings like the present, in which each discussion demonstrates the identity of interests, that teachers and managers together learn the old homely lesson that union is strength, and that in the nurturing of our children "in the chastening and admonition of the Lord" (as the Revised Version rightly has it) we are members one of another. The good that has been done in this great matter by the Association of Church School Managers and Teachers, and by each annual congress like the present, is simply incalculable. To those wise spirits who laid the foundations of this association, and devised the recurrence of these pleasant and profitable meetings, the Church of England and the sacred cause of religion generally owe a great debt of Christian gratitude. I may next allude in words not only of congratulation, but of hearty thankfulness to Almighty God, that, in spite of the general depression which has affected, as we know, to a large extent, the supporters of our country Church Schools, the progress in the past year has, nevertheless, proved to be distinctly encouraging.'

After some observations on the financial statements, standards of average attendance, general efficiency, etc., his Lordship concluded by saying that everywhere among church managers and teachers there must be

'vigour and promptitude. The call now is pressing, and the work to which we are called holy and patriotic. The future of the Church, the future of our country, the future of the dear children growing up around us, all depend upon our efforts at the present time more distinctly than at any other period in the past eleven years. If we would preserve our Church schools and our Church teaching, we must strengthen our weak places, and build up that which is decaying. There is time and there

is hope. God grant that we may wisely buy up the time, act upon the hope, and work onward with heartiness and courage!'

At the second session, held in the evening of the same day, the Bishop again presiding, the Rev. M. A. Nisbet read an able and suggestive paper on 'Night Schools.' He dwelt on the influence possessed by teachers and managers, and said that

'the future of the English race rested in the hands, humanly speaking, of the managers and teachers of the schools in England, and therefore very largely in their hands. If they rose to a true sense of their responsibilities—if in a catholic, charitable, and God-fearing spirit they educated those committed to their care—if in a loving and sympathetic spirit they gave of their time and strength to help them when, having left school, they were first exposed to the world's temptations—God would bless their efforts; their children would grow up as loyal citizens and faithful members of the Church of England; and all men—all who loved their country, and desired its real prosperity—would feel and acknowledge that it is indeed a most happy thing for the land that the teachers of our National Schools are an earnest body of men and women, and that our children are being trained by them in the fear and "admonition of the Lord."

The third session was opened by the Lord Bishop of Gloucester and Bristol on June 2nd, at ten o'clock. It was devoted chiefly to a discussion of the New Code, an admirable and discursive paper on which was read by the Rev. H. Roe, F.R.A.S. In the discussion which followed, Canon Gregory said that

'as regarded the New Code he welcomed it in every one of its stages. He thought it better than the old, but there was always a difficulty in changing from one system to another. He believed there had been no thought so much present in the mind of Mr. Mundella as that of the small country schools. He believed the framers of the New Code wished not to injure but to help small country schools. The new scheme offered an advantage in the matter of children being prevented from attending school through bad weather. In the long run teachers would find themselves better off in respect of difficulty of attendance.'

The fourth and concluding session of the Congress was held in the afternoon of June 2nd, at three o'clock, under the presidency of the Bishop, to whom a vote of thanks was unanimously given for his attendance during the preceding sessions. The business of the Congress was brought to a close after a short discussion on the New Code and Class Subjects and Music.

SHAKSPEREAN EXAMINATIONS FOR PUBLIC ELEMENTARY SCHOOLS—1883.—The Committee of the Dramatic Reform Association have set on foot Annual Shaksperean Examinations, and offer prizes for competition, in order to encourage the study of the best dramatic literature in public elementary schools. The play selected for the examinations to be held in 1883 is 'Julius Cæsar.' Competitors will be required to have a general knowledge of the whole play, but a special knowledge of Act I., scene ii., line 79—177; and of Act III., scene ii., line 71—228. Text-books: The Clarendon Press, Collins', Chambers', or Hunter's edition of the play. The examinations will be *written* and *oral*. The purpose of the written examination will be to test the competitor's knowledge of the play—of historical or mythological allusions—of the sources whence the plot is derived—and of the meaning of peculiar phrases, words, etc. The oral examination will test the competitor's powers of elocution, either by recitation or reading. Although recitation is not compulsory, more weight will be given to it than to reading. These examinations will be held at the end of June, 1883. *Regulations.*—The following are the regulations for the examination in Manchester:—All public elementary schools in Manchester, Salford, and neighbourhood may take part in the competition—there is no entrance fee. Each school will be allowed to send up two per cent. of the number on its books; competitors should have passed the fifth standard. There will be a preliminary examination in reading or recitation in April, 1883. *Prizes.*—The first prize will be awarded to the competitor who obtains the highest total of marks in the written and oral examinations put together, the proportion of marks being two-thirds of the former, to one-third of the latter. The two next prizes will be of equal value, and will be awarded to the two competitors—neither being the winner of the first prize—who shall respectively obtain the highest number of marks for paper-work or for elocution. The remaining prizes will be awarded to those competitors who obtain places after the first and second in the written and in the oral examinations respectively—an equal number being assigned to each. The names of intending competitors should be sent in to the Honorary Secretary, D.R.A., Mr. J. STUART BOGG, Higher Downs, Bowdon, Manchester, prior to January 31st, 1883.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose name and address we will gladly give.

Lamb's Tales from Shakespeare. Whittaker and Co.

This shilling handbook of an amusing and instructive batch of famous stories is worthy of a large sale, albeit the print is trying to the sight; but if the public will demand such cheap editions, they cannot expect them to be *de luxe*. It is well known that Charles Lamb was mainly helped in these tales by his poor mad sister, in her saner seasons, and that 'the gentle Elia' delighted in them for her sake, as making her forget the tragedy of her life.

Plutarch's Lives for Everyday Readers. Whittaker and Co.

Another little book produced in the same style, and chiefly remarkable for the omission of certain passages in the original, which could not fail to offend modern decency and morality.

A Handy Classical Dictionary. Whittaker and Co.

The same remarks apply to this small manual also. All the series appear to be well suited for the popular advantage.

Grammar School Classics. Whittaker and Co.

1. *Virgil's Georgics, I. and II., with English Notes and Arguments.* Abridged from Conington by the Rev. J. G. Sheppard, D.C.L., Head Master of the Grammar School, Kidderminster.

A very attractive little handbook, that cannot but recommend itself both to teachers and pupils.

2. *Virgil's Æneid: Books I. and II.* Similarly abridged by the same Editor.

A companion small volume, with the like recommendations. It is a great improvement on the classics of our boyhood to find the explanatory notes in easy English, instead of a dog Latin more difficult than the text; and the arguments and introductions are an additional advantage.

3. *The Anabasis of Xenophon: Book I.* With notes, introduction, an itinerary, and three maps. By the Rev. J. F. MacMichael, B.A., Head Master of the Grammar School, Ripon. Revised edition.

This beautifully-printed Greek classic, with English notes, preceded by a life of its celebrated author, and an elaborate introduction, is another of the useful school-books issued by Messrs. Whittaker, which help to make the ascent of the Mount of Knowledge a pleasure instead of a toil. We cannot sufficiently recommend such excellent manuals.

Anecdotal Illustrations of the Gospel according to St. Mark. Founded on a collection made by J. L. Nye. London: Wesleyan Methodist Sunday School Union.

This is a pleasing and most readable book which, while being explanatory of the sacred text, is brim full of anecdote bearing the impress of truth and soberness. Many religious anecdotes have the fault of being too highly coloured, and give exaggerated illustrations of human effort. We have no such complaints to urge against the little book before us. The illustration of a miracle given by a reverent Scot is similar to that adduced by Babbage in his Ninth Bridgewater Treatise—that the miracle is an alteration of the usual procedure, commonly called the laws of nature, and not a violation thereof. We have in this pleasingly written book some of the most popular of modern writers placed under contribution, among which we may mention Dean Stanley, Mr. Hughes, Colwell, 'The Land and the Book,' Dr. Geikie, 'The Dictionary of Illustrations,' Grossart, and others, besides the valuable and always suitable remarks of the author. The book is also well printed, and in neat cloth binding.

The Monograph: a Collection of Indexed Essays. By Q. P. Index. Bangor, Maine (United States), 1882.

The idea of collecting the most successful essays that have graced the pages of our leading quarterlies, has been carried out by us chiefly in connection with authorship. Those of Macaulay have doubtless attained the greatest popularity. For particular essays most readers endeavour to buy up the particular numbers of the leading periodicals when they are offered at some fifth or sixth of the original cost. We know of no plan to supersede such a method of selection. This monograph comprises essays on historical subjects, together with the biographies of leading characters, treated in essay fashion. The first annual volume, of which we have a selection forming a specimen number, opens with Mr. Freeman's 'France,' and contains also Goldwin Smith's 'Greatness of the Romans,' Seeley's 'Puritan England,' Shelton's 'Fouquet.' This latter, reprinted from 'The Atlantic Monthly,' excited considerable attention last autumn. Read side by side with the life of Mazarin, the wily nature of the selfish Louis XIV. will be traceable greatly to the incessant broils through which the astute Italian conducted, though with difficulty, the mother Queen, whom he eventually married. Those who seek for historical parallels may trace many points of resemblance between the French King and our Henry VIII. There was the same intense love of absolute power, the same energy, self-reliance, and the same mixture of envy, meanness, and greed, with the absence also of the noble hatred of the crooked and dishonourable that forms the saving feature of a gentleman, however harsh and overbearing. The most brilliant essay, however, in the part before us, is Goldwin Smith's 'Thirty Years' War,' and the weakest that on Calvin and Servetus, by W. L. Bacon, which latter is largely made up from an article on Servetus which appeared in a not very recent number of 'The Westminster Review.'

A Latin Grammar. By J. R. Leonard. Thomas Murby.

There are many useful hints and facts in this little book which make one wish it had been more thoroughly revised and more carefully printed. It commences with a short account of the Latin language, and a useful list of the chief Latin authors and their works. We agree with Mr. Leonard when, in reference to the pronunciation of some words and phrases borrowed from Latin and introduced into the language of common life, he says that certain rules have been 'so much disregarded by persons of good classical education, that it is very difficult to decide whether we should be guided by the well-established pronunciation or by classical accuracy. Following the latter, we should pronounce the first *a* in *Diana* long, and the *e* in *Venus* short, and should say *Nota bene*, *bonna fidde*, *minnus*, *et caetera*, etc.'

The usefulness of the book for school work is sadly marred by the numerous typographical and other errors which appear in it, and by the general want of clearness in both arrangement and expression. We do not, for instance, think that the author's meaning is very plain when, on page 14, the pronunciation of ph, th, is given as p+h, t+h, nor do we quite agree with him when, on the following page, he says that in such a phrase as '*thrice consul*,' the adverb *thrice* qualifies the noun *consul*. It seems to us rather to qualify some such word as '*appointed*' understood.

We may add, too, that when a *period* or *full-stop* is placed after a word it means that this word is the abbreviated form of some longer word. Such forms, therefore, as Cum., De., Ex., which occur in the list of prepositions on page 64, are misleading.

With all its faults, however, Mr. Leonard's book contains much that is useful and interesting.

The Oxford Examiner. No. 3. Edited by Mary W. J. Shilleto. London: Thomas Laurie, Paternoster Row.

This new magazine deserves to succeed. It affords the best help (in the form of examination questions) to students preparing for the Oxford Junior, Senior, and Women's Examinations.

A Descriptive Catalogue of Historical Novels and Tales. By H. Courthope Bowen, M.A. London: Edward Stanford.

We thank Mr. Bowen for this handy booklet, which should find its way into every school and library in the kingdom.

The Pocket Code and Teachers' Daily Handbook. By C. Bowden. Newcastle: Porteus and Co.

We are very much mistaken if teachers do not accord Mr. Bowden their best thanks for this really serviceable pocket-book. Its design is, to quote the preface: (*a*) To place in the hands of every teacher in the school the daily requirements of the Mundella Code; (*b*) To obviate the necessity of a constant appeal to the general time-table of the school by giving each teacher the opportu-

nity of carrying the whole or a part of it in his pocket; (*c*) To provide in connection therewith a note-book to record any instructions given or received either as regards lessons or classes throughout the year; (*d*) and generally to serve as a handy means of reference to the daily routine work of the school. This comprehensive and excellent design has been well carried out.

Caldicott's New Code. London: Blackie and Son.

Mr. Caldicott has rendered managers and teachers good service in issuing this carefully tabulated edition of the Mundella Code. Under the heads, 'Schools or Classes for Older Scholars,' 'Infant Schools or Classes,' 'Evening Classes,' and 'Drawing for Day Schools and Pupil Teachers,' he has given every kind of information an intelligent teacher could desire. An additional advantage of this edition is that it contains a list of books published by the Messrs. Blackie, specially suited to the requirements of the New Code.

Our Little Ones. London: Griffith and Farran.

The number of this magazine, just to hand, is beyond praise.

Short Essays and Letters. Manchester: J. B. Ledsham.

It is with sincere pleasure we introduce this modest looking packet of twenty-four cards (each different) to the notice of our readers. Every card contains either a 'model' essay or letter, couched in simple language and designed for copying, dictation, or analysis. Many of the subjects dealt with have actually been proposed by Her Majesty's Inspectors of schools. These cards meet a long-felt want, and their introduction into any school must be followed with most satisfactory results.

Universal Instructor. Part 19. London: Wa and Lock.

This useful serial keeps up the high character of i earlier numbers.

Roach's Practical Examiner's Arithmetic Tests. London: Thomas Murby.

Many teachers will welcome these cards because th sums are not too stiff. There is an ample variety exercises on the twenty-four cards, each of which contai five different sums. Three answer cards accompany t packet.

The A B C Education Code. London: Nelso and Sons.

To many people, and especially to young correspo dents and managers, the ever changing code is a kind inexplicable 'Bradshaw.' It was therefore a happy id to issue this simplified A B C Code of March 6th, 18 which contains every article and every schedule arrang under alphabetical headings. The publishers may ther fore well claim for it the advantages of ease, directne of reference, and completeness of view.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

VI.

CHILBLAINS AND CHAPS.

CLOSELY allied to boils in appearance, but not in cause are the swellings which are produced by frost and cold. Chapped hands arise, in a great measure, from neglect in not sufficiently drying them after they have been washed. If they are exposed to the cold air in a damp state, the effect of evaporation is to chill the cuticle. When there is a low state of vitality in the system the consequence is soon manifest. The cuticle is destroyed, and is thrown off before its natural exfoliation is complete. The result is a rapid rise of a so-called inflammatory action. Heat, redness, a swelling with some amount of tenderness, supervene in the swollen part. Some children are much more susceptible to a chapped state of skin than others, from constitutional weakness. When the chilled condition has extended to the cutis vera, or true skin, a chilblain is produced. These effects are very prone to form in those who have a weak circulation; who are the children of persons who have been addicted to high living; who have trusted to meat and stimulants as the staple articles of food, rather than to more simple diet, and who have not had a proper supply of milk and vegetables. The fingers and toes, the tips of the ears and nose, sometimes parts of the skin on the arms and legs are affected. In the case of chaps, the mischief is limited to the cuticle. Every one who does not dry the skin thoroughly is liable in cold weather to have this condition produced. The greatest care should be taken to remove all moisture from the skin, especially in cold and frosty weather. It is beneficial to smear the hands with a minute quantity of honey, after washing and before drying, when the weather is really cold. The application of honey makes the drying a more tedious process, but it is capable of being more thoroughly performed than when honey is not used. If the chaps have been actually produced, and the skin is cracked, it requires the application of something more stimulating than honey. I generally use an ointment such as the following:—One part of camphor, six parts of spermaceti ointment, and one part of citron or golden ointment. These should be thoroughly well mixed, and the cracks smeared with the mixture at bedtime, after the hands have been well washed and properly dried. Two or three applications will be sufficient to effect a cure. The parts smeared with the ointment should be covered up by berlin or silk gloves. The lips are sometimes chapped; they should be painted with a little solution of the tannate of glycerine, and the application allowed to remain upon it for a few minutes before it is wiped off. The cracks should then be touched by a little strong camphorated oil—four parts of salad oil, and one of camphor, being rubbed together so as to make an application; the thinnest possible coating should be applied by the aid of a camel's-hair brush; or a camphor ball, such as all druggists supply, may be used. If the chill has extended to the cellular tissue, there is active inflammation. The vitality of some of the minute capillaries has been interfered with, and the blood has stagnated in them. As a consequence, there is obstructed circulation, and a local dropsy results. Children who have been accustomed in cold weather to wash in hot water are more liable to chilblains than others, especially if they have been improperly fed. Any sudden change of temperature, ranging below 40° may produce chilblains, though they are much more decided when the temperature is absolutely below the freezing-point. Those adults who are accustomed to wash their hands in hot water in frosty weather are very liable to them. Children whose feet are kept too hot, or who are badly shod, and who get their feet damp in severe weather, suffer much from the effects. There is impeded circulation, then an intolerable itching, and scratching only adds to the pain and the inflammation. If the malady be properly treated, it remains a simple chilblain, and is soon removed, but if the process of exposure be continued, if it be scratched excessively, the skin breaks, and the cellular tissue beneath is exposed, and then a painful sore results. The best kind of treatment is a gentle friction with a warm hand. If the skin is not broken, the part affected may be covered up, and supported by chamois leather spread with lead plaster; but if the skin be broken, a stimulating ointment may be applied. The best kind

is, one part of turpentine rubbed up with seven parts of yellow basilicon, and applied on lint twice or three times a day, taking care to keep the affected part perfectly dry. Persons who are very sensitive to cold, and upon whom chilblains easily appear, should take a dessert spoonful of cod-liver oil every night on going to bed, when the thermometer shows a temperature constantly below freezing point. Stimulants, such as wine and beer, will not assist to remove the cause which allows of the production of chilblains, although they are remedies which are much vaunted by some authorities.

I can scarcely pass over the subject of frost-bite, though it rarely happens in this country, but now and then a child does inadvertently get frost-bitten in very severe weather. A condition, which corresponds to that producing chilblains, extends in the tissues beneath the skin until the vitality of the organ may be entirely destroyed. There is numbness at first; an attempt is made to restore the circulation, there is intense pain; the mischief is done before the latter arises at all; when children's fingers are frost-bitten, as will happen sometimes when they are intent upon snow-hut building, or even snow-balling, it is very imprudent to warm them by exposure to a fire, or by plunging them into hot water; the chilled part should be only rubbed with a warm hand, using at first a little snow-water, and then simply the heat of the hand itself, and very gently, too, until the deadly pallor in the part which announces the arrest of circulation gives way to a more florid aspect. This must be done carefully and slowly, otherwise mortification will be the natural result. Powerful stimulants are to be utterly avoided; they are certain to produce mischief. Some other directions will be given upon this head when treating of the rescue of drowning persons.

Diseases of the Skin.

The transition from boils and chaps and chilblains to diseases of the skin appears to be a most natural one, but it is not strictly scientific. As, however, we are treating this subject from a popular point of view, we may consider this troublesome and disagreeable set of cases at this part of our subject. The skin is often much damaged by the continuous poulticing to which boils and blains are but too often subjected, and some of the most obstinate skin affections date their commencement from some application which has been used for some other object. I have already treated of the class of maladies which are styled eruptive fevers, or 'the Exanthemata,' as they are termed by medical men. They are attended by high fever, and are all infectious or contagious. They include Measles, Scarlet Fever, Small Pox, '*et id genus omne.*' Another class of infectious complaints, which are truly parasitic, affecting the hair and skin, have also been already dealt with. It remains now only to take account of those diseases of the skin which are called tetters, breakings out, scorbutic affections, etc. They are chronic in their course, and are not usually attended by feverish disturbances. Some of them are very difficult to cure, and leave lasting impressions behind them. There are several distinct classes, such as papules or pimply diseases; squamous or scaly affections; others are vesicular or pustular. These divisions are not natural, a papule may become a pustule, and a vesicular disease, such as eczema, may lapse into a scaly kind. Others are simply blisters, whilst the disease called Itch may take on almost every kind of form, viz., pustular, papular, or vesicular. There is no truly natural classification for skin diseases, but for convenience of description I will take them in the following order:

1, Papules. 2, Scales. 3, Vesicles. 4, Pustules.

Papules.—These are small elevations of the cuticle with hardish bases; they do not suppurate or form pus; after a time (sometimes extended) the hardened base declines, a small scale forms, which is not exactly a scab; it rubs off, generally in consequence of some itching, or when it appears on the face by the act of rubbing; it may recur in the same place. There are several kinds of papule: (1) Acne, (2) Strophus, (3) Lichen, (4) Prurigo.

Acne.—This affection is common upon the faces and necks of young people; it is caused by an inflammation of the sadiparous or oil glands, and the tissues immediately adjacent. The sebaceous matter is concreted into a solid form; it distends the excretory duct and even the hair follicle. It then comes into contact with the dirt contained in the air, and forms a black spot on the skin. These are sometimes squeezed out and a thin maggot-like body exudes. Children are wont to describe the victims of this disease under various fanciful names. It is more frequently seen in young men and women just as they approach the age of puberty than in younger children, and usually disappears in the course of a few years. It is more usually met with in those parts of the body which are exposed to the influence of the atmosphere. There are several varieties, as the simple, the indurated, the punctuated, and the form called Acne Rosacea, in which the integument around assumes a livid hue. This last is not often seen in young people; it is more usual in those who, having transgressed the rules of propriety, have their errors discovered later on in life, and whilst the simple forms are easily removed, Acne Rosacea is most intractable.

Treatment.—The simple form may usually be got rid of by a proper application of soap and water, with gentle or vigorous friction, according to the condition of the base of the papule. Friction with sulphur-ointment is useful at times, and in obstinate cases a lotion containing one grain of bichloride of mercury in an ounce of emulsion of bitter almonds will generally remove the complaint. The lotion should be applied at bedtime, a little being rubbed into the orifices of the glands which are faulty. The general health requires attention; fresh air, exercise, attention to diet, and some saline laxative may all be indicated according to the habits of the person affected.

Strophus or Red Gain, or tooth-rash, is a malady affecting infants, and need only be mentioned here; it is closely allied to Lichen; it requires attention to cleanliness, and the removal of causes of intestinal irritation which are common among infants.

Lichen is an eruption of minute papules, reddish in colour, conical in shape; they produce an intolerable itching, and terminate in a branny kind of scale, which causes a shower of debris when the under-garments are changed. There are several varieties, which have distinct names, derived from the shape of the patches, position of the papules, or colour of the neighbouring skin. Lichen tropicus is the prickly heat of the tropics. They all appear usually without any constitutional disorder. They are not common among children, are

often intractable, and can scarcely be cured without the aid of the surgeon; cleanliness, attention to diet, and frequent bathing in waters containing a small quantity of vinegar, one part in 500, is the most useful plan.

Prurigo is characterised by a thickened and discoloured state of the skin, common in old age, unusual in youth; the papules are isolated and scarcely differ in colour from the surrounding cutis. There is a burning itching; it requires medical treatment for its cure.

(To be continued.)

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.
AND THEODORE WOOD, M.F.S.,
Joint Author of 'The Field Naturalist's Handbook.'

No. XVIII.—THE BEAR TRIBE.

PART I.

THE BEARS (*Ursidæ*) are generally considered to form one of the families of the *carnivora*, although, in the strict sense of the word, they are not flesh-eating animals. In their wild state their diet appears to be of a mixed nature, consisting partly of snails and other small creatures, but chiefly of fruit, honey, and roots. They seem but seldom to attack the higher animals, unless when their ordinary food is not to be procured, and, as a general rule, are singularly harmless and inoffensive animals, unless attacked or otherwise annoyed.

In captivity it is found that bears thrive very well upon an exclusively vegetable diet, animal food being seldom or never given to them. The Polar bear, of course, forms an exception to this rule, its natural surroundings rendering it an almost entirely carnivorous animal.

All the bears are plantigrades, that is, the entire sole of the foot is placed upon the ground when the animals are standing or walking. Strange as it may appear, this structure renders them far more capable of assuming an erect position than is the case with any of the monkey family, although the hinder feet of the animals of this latter group approximate so much more closely to those of the human form. Indeed, a bear seems fully as much at ease when standing erect as when upon all fours, and usually assumes an upright position when attacking a foe.

The paws of the bear are armed with long and sharp talons, which, however, are not retractile like those of the animals of the cat tribe. These claws form most terrible weapons when urged by the powerful muscles of the fore-limbs, a bear having been known to scalp a man by a single blow of the paw.

The mode of attack seems invariably to be the same. Approaching to within a short distance of its enemy, the bear halts for a second, rears itself upon its hinder limbs, and delivers a series of terrific blows with the fore-paws, always directing them at the head of its adversary. Should these fail to take effect, it enters upon a different system of attack, and endeavours to seize its foe round the body, and crush him to death by the tremendous pressure of the fore-limbs.

Few animals are more formidable than an enraged bear, no matter of what species, and even an experienced hunter hesitates before encountering one of these animals, except under very favourable conditions. And the animal becomes a more terrible antagonist from its extreme tenacity of life, and from the concentrated energy and fury which it exhibits after receiving a fatal wound, during the last few moments of its existence. Nothing less than a ball through the heart or brain appears to cause instantaneous death, and any less immediately fatal wound appears only to stimulate the animal to fresh and more energetic exertions.

THE first bear upon our list is the Brown Bear (*Ursus Arctos*) of Europe and Asia, an animal with which most of us are more or less familiar. It is a large animal when fully grown, an adult specimen averaging about eight hundred pounds in weight when in good condition.

The fur of this animal is of a uniform brown tint, varying slightly in different individuals. When young a white band is sometimes found encircling the neck of the animal, which, however, almost invariably disappears in the course of two or three years.

The brown bear is tolerably plentiful in the mountainous forests of many parts of Europe and Asia, but in spite of its strength and powers of destruction, is by no means so great a foe to the farmers as might be imagined. Indeed, a cattle-eating bear appears to be the exception and not the rule, the animal generally contenting itself with a vegetable diet, and allowing the flocks to rest in peace.

If, however, the bear should once break through its usual habits, and make a meal upon some cow or sheep, it becomes a confirmed cattle-eater, visiting the folds night after night in order to appease its hunger with the flesh of one of the enclosed animals. In such a case, there is no rest for the farmer until his voracious foe is slain, and his flocks can once more repose in safety from its attacks.

Two very favourite articles of diet with the brown bear are to be found in the insect world, ants furnishing the one, bees the other. Of the former insects the bear is very fond, tearing the nests open with its paws, gathering the ants and their pupæ into its mouth by means of its tongue. Beehives, too, frequently suffer from its attacks, both the insects and their sweet produce being speedily entombed in the body of their destroyer. The animal does not fear their stings, its thick long fur proving an effectual bee-dress. The brown bear affords us a very good instance of perfect hibernation, passing the entire winter in a state of torpor. Towards the autumn, the animal becomes extremely fat, and, about the end of October, sets to work and prepares a suitable chamber in which to pass the chilly months which must intervene before springtime again makes its appearance.

This hiding-place is usually situated among rocks, or beneath the roots of a tree, where the animal will not be exposed to the direct action of the elements. Should such a spot be unattainable, however, the bear constructs a kind of hillock of moss, in which it takes up its abode. In spite of their size, these hillocks are by no means conspicuous, for the deep snow usually conceals every trace of their presence.

Having once fairly entered upon the period of enforced repose, a singular phenomenon takes place in the system of the bear. The stomach and intestines, being

no longer supplied with food, contract very considerably, and the passage is, moreover, blocked by an obstruction, technically known as 'tappen,' so that nothing can possibly pass from the system. This 'tappen' generally consists of pine-leaves, and various substances swallowed by the bear together with the ants of which it is so fond. In constructing its retreat, the bear is very careful of its personal comfort, and carefully lines the floor with a soft bed composed of dried leaves, moss, and other substances of a similar nature.

Secure in its winter retreat, the bear passes the cold months in a state of torpid inaction, subsisting, meanwhile, upon the fat which it has accumulated previous to entering upon its long repose. Yet, strange to say, very little difference is manifested in its condition, for the hunters tell us that if the *hibernaculum* of a bear be opened before the expiration of the winter, the animal is fully as fat and sleek as before it retired to its retreat. The period of inactivity lasts for about five months, the animal returning to the outer world towards the middle of April.

The young of the bear, from one to four in number, are brought forth while their parent is still in her winter retreat, this event usually taking place about the end of January. It is a curious fact that, although at the time of the birth of her cubs, the mother has been deprived of food for upwards of three months, she is yet able to nourish her offspring until the time comes round for her again to make her appearance in the world.

When taken young, the brown bear is easily tamed, and shortly becomes perfectly domesticated, almost as much so, indeed, as a pet dog or cat. Being naturally of a mild and gentle disposition, tame bears of this species have often been allowed to roam about the house with perfect freedom, seldom or never abusing the confidence reposed in them.

This is the animal whose fat, popularly known as "bears'-grease," is, or perhaps was, in such estimation as a means for increasing the growth of hair. The hunters who are necessarily practical naturalists, are aware that the bear, like the squirrel and other hibernating animals, is fattest towards the end of autumn, and consequently they choose that time of year for bear-killing.

I regret to say that the high repute of bears'-grease has been the cause of many frauds. Indeed, if every bear that was killed in any one year were composed entirely of fat, the amount of bears'-grease would not equal the hundredth part of the annual quantity sold in the shops.

My lamented friend, the late Frank Buckland, tells an amusing story of bears'-grease.

Not many years ago, hair-dressers used to advertise the day on which they were going to kill a bear. Readers of Dickens will remember that one of his most humorous stories is founded on this custom. The romantic hair-dresser in question seems, however, to have really slaughtered real bears and sold the genuine fat; whereas, as a rule, no bear was killed, and hogs' lard took the place of bears'-grease.

The hair-dresser in Mr. F. Buckland's story was clever enough to kill the same bear three times weekly. He had one real live bear, which he kept in a cage visible to the public. He had also a skin (head included) of the same kind of bear. On killing days, the bear was withdrawn from the cage, and presently a terrific noise of angry growls, shouts of men, rattling of chains, and so forth, was sure to attract a large crowd. After awhile the proprietor, all flushed and panting came into the shop, and hung up the (apparently) newly flayed skin of the slaughtered bear. Then his cart, with a large box in it, drove off to the docks to fetch another bear. Next morning a fresh bear was to be seen in the cage.

Unfortunately for the ingenious hair-dresser, the secret leaked out unexpectedly. The yells and growls of the wounded bear were produced by a costermonger popularly called 'Leather-mouthed Jemmy,' who was retained to enact the part at a fee of five shillings for each performance. On one occasion he was dissatisfied, quarrelled with his employer, and then the whole ingenious deception was exposed.

The hair-dresser was careful that the new bear should be never quite like its predecessor, and darkened or lightened the hue as required, by the means of blacking and flour. But the bear and the skin were carefully made to agree in hue, and then the latter was greased and streaked with blood before it was hung up.

I have heard of another case where the hair-dresser used to allow his customers to rub their heads against the actual fat of the slain animal as it hung in his shop. The man had a real bear-skin, but used to insert within it the carcass of a large pig which he hired for the day.

THE bear so often mentioned in Scripture belongs to the species known as the Ritck, Dubb, or Syrian Bear *(Ursus Isabellinus)*, an animal which is far from uncommon in the mountainous parts of Palestine. It appears to prefer the summits of the loftiest mountains, being often found even above the line of perpetual snow.

In order that it may be enabled to withstand the extreme cold of its native haunts, the fur is of double thickness, so to speak; a thick covering of woolly fur lying beneath the longer hairs, which alone are visible without close examination. The colour of the fur varies at different periods of the animal's existence, being of a brownish-grey hue while the bear is yet young, and becoming gradually paler as the years roll on, until, when the animal reaches maturity, it is almost white.

The nature of the Syrian bear is remarkably gentle, and it is seldom known to molest a passer-by unless it is attacked or greatly annoyed. It is almost entirely a vegetable feeder, and sometimes causes considerable damage in the plantations in the neighbourhood of its haunts. It feeds by night only, descending from the mountains when darkness sets in, and returning shortly before the break of day.

TURNING to the American continent, we find that it furnishes us with two very well-known bears, namely, the Musquaw, or Black Bear, and the terrible Grizzly.

The first of these *(Ursus Americanus)* is a native of various parts of North America, where, although it is still found in some plenty, it is sensibly decreasing in numbers, owing to the constant attacks of the hunters, who find in the fur and the fat two very valuable articles of commerce. The flesh, also, when properly cooked, is always considered as a great dainty, alike by civilized and savage hunters.

The black bear is an excellent climber, and obtains a large proportion of its food by the exercise of its scandent powers. Few trees will baffle a musquaw when upon the look-out for a wild bees'-nest; and few obstacles will render the saccharine treasures secure when once discovered by the eager and powerful animal. Tooth and claw are alike brought into requisition, and, even if the prize be deeply buried in the hollow of a tree, the bear is sure before very long to tear open a passage, and so obtain the coveted dainty. Success attained, the subsequent proceedings of the bear are of a very summary character, combs, grubs, and perfect insects alike being crammed into the mouth as fast as possible, the animal paying no attention whatever to the remonstrances of the aggrieved owners of the hive.

Quiet and retiring as are its habits when unmolested, the black bear becomes a truly terrible foe when pursued and brought to bay. Launching a shower of tremendous blows with its powerful forepaws at the head of its foe, the animal seems literally carried away with fury, nothing short of a bullet in the heart or brain checking the course of its passion. Many a hunter has perished beneath the claws of an enraged musquaw, which, indeed, when once provoked, seems little inferior in strength and courage to the dreaded grizzly itself.

During the first year of its existence, the fur of the musquaw is of a light grey tint, very different from the glossy black colour which it afterwards assumes. So different is it, indeed, that for many years the young musquaw was thought to belong to a separate species, and was known as the Yellow, or Cinnamon Bear. The fur is shed twice in the year, namely, in spring and autumn.

Like the brown bear of Europe and Asia, the musquaw is accustomed to pass the winter in a state of torpor, concealing itself during the autumn in some snug retreat, where it may be protected from the inclemencies of the weather. Experienced hunters tell us, however, that unless the bear is in good condition when the time for its hibernation arrives it does not trouble itself about a winter retreat, but roams the forest throughout the winter in search of food.

OF all the bear tribe, the terrible Grizzly Bear *(Ursus ferox)* of North America is—with the exception of the Polar bear, which some naturalists will not allow to be a true bear—by far the most savage and powerful. Unlike all the other members of its tribe, except, perhaps, the Polar bear, it will attack a man without receiving the slightest provocation, although, curiously enough, it will not follow up his track. Indeed, the scent of a human being appears to exert a strange influence over the bear, which has more than once been known to relinquish its designs upon a man whom it was proceeding to attack, merely upon experiencing the detested odour.

Should it be wounded, however, the human scent appears to lose its deterrent power, and the animal rushes upon his foe with desperate and reckless fury. Woe betide the hunter if his nerve tremble, and he thereby lose the single chance of a fatal shot which the bear is likely to allow him, for in all probability his doom is sealed.

This solitary opportunity of inflicting a mortal wound is afforded by the habit of the grizzly bear of halting for a second when within a few feet of its victim, in order to rear itself upon its hinder limbs. Should the hunter fail to take advantage of this brief pause, or should he not succeed in inflicting an instantaneously mortal wound, he has but a very slender chance of escaping with life; for the grizzly bear is perhaps even more tenacious of existence than the rest of its kind, and will certainly wreak dire vengeance on its enemy before itself succumbing.

By the native tribes of North America the warlike propensities of the grizzly bear are held in the greatest reverence, and any warrior who is fortunate enough to kill one of these animals in single combat is regarded almost with adoration by his less-favoured comrades. The successful hunter always constructs a necklace from the claws of his slain foe, which he proudly wears, as a visible token of his prowess in the chase. Such a necklace is the equivalent of our Victoria Cross, and it is hardly possible to persuade the owner of such a trophy to part with it on any terms.

A natural dread of the grizzly bear seems to be implanted in the breasts of every animal inhabiting the same land. It is even said that no beast of prey will venture to interfere with the carcase of any creature slain by the bear, even though he may long since have deserted the body of his victim.

Even the most carefully trained horses can scarcely be induced to face the grizzly bear, or 'Ephraim,' as he is generally termed by the hunters; and evince great terror if they are merely required to carry the skin taken from the body of a slaughtered specimen.

A full-grown grizzly bear is a very large animal, weighing from eight to nine hundred pounds, and averaging about eight feet six inches in total length.

It is difficult to obtain a correct idea of the size of an animal merely by a statement of its measurements, and we can scarcely appreciate the huge dimensions of this bear unless we compare it with that of some object with which we are well acquainted. Let us, therefore, by way of illustration, suppose that we have before us a man six feet in height. Now let us take a child of five or six years of age, and stand it erect upon the crown of our man's head. Then let us multiply the girth of his body by three, and cover him with long shaggy hair, and we shall have some little idea of the huge bulk of a grizzly bear as it appears when rearing itself upon its hind legs in readiness for attack.

The paws are of great comparative size, measuring nearly eighteen inches in length, and armed with claws fully five inches long. It is a rather curious fact that the animal possesses the power of separately moving any single claw, without reference to the rest.

These formidable claws are used for various purposes besides those of mere attack and defence, such as digging in the ground for the roots and bulbs which form a considerable part of the diet of the bear, or in burying the carcases of the animals which have fallen victims to their terrible foe.

By their aid, too, the bear is enabled to climb trees, at any rate during the first few years of its life. It would seem, however, that when it attains to adult size, the bulk of the body is too great to be sustained merely by the hold which the claws are able to obtain in the crevices of the bark; many hunters having escaped from an infuriated grizzly bear by ascending some convenient tree, into which their ursine foe made repeated but ineffectual efforts to follow them.

While still young, however, the bear is frequently in the habit of ascending the oak-trees in order to obtain a supply of acorns, which it procures by violently shaking the boughs, and then descending to the ground in order to feast upon the results of its exertions.

Notwithstanding its fierce and savage disposition, the grizzly bear has more than once been tamed; such animals, however, having always been taken while still quite young. Many amusing stories are told of the freaks of these domesticated bears, which, however, seem at the best but rough and rather dangerous pets.

The fur of the grizzly bear is very variable in colour, so much so, indeed, that some writers have considered that there are two separate species included under one name. While the animal is still young, the fur is of a brown colour, with a dark stripe running along the spine. At this period of the animal's existence it is so thick and long that it shakes up and down at every movement of its owner.

In the adult animal, the fur varies in colour from dull brown, irregularly sprinkled with grey hairs, to an uniform greyish white. In the coat of all specimens, however, something is found of the "grizzled" nature from which the animal derives its popular title.

The head is larger in proportion to the size of the body than is the case with bears in general, and the tail is so short as to be completely concealed from view by the long hairs of the hinder quarters.

(To be continued.)

Eminent Practical Teachers.

PESTALOZZI.—(*Conclusion.*)

BY THE REV. CANON WARBURTON, M.A.,

Her Majesty's Inspector of Training Colleges for Schoolmistresses.

VI.

'A MAN should know something about everything, and everything about something.' It was a very shallow retort on the part of a distinguished architect, to whom complaint was made that a building which he had erected was crumbling to pieces from defective materials: 'I am an architect, and not a brick-burner.' A consummate artist is bound to be acquainted with the minutest details involved in his art, and an architect should have learned not only how to burn bricks but to lay them; should be well acquainted with the relative strength and durability of materials, and so ascend through statical certainties and common-places to these grand imaginative conceptions by which monumental structures are raised, and domes 'hung high in air,' defying the assaults of time. Those who have taken the trouble to read the former notices of Pestalozzi in this journal will have seen that he possessed in a remarkable, perhaps in an unequalled degree, the gifts by which children's hearts and sympathies are won. He was never so much at home as when surrounded by a circle of little folks, with a child upon his knee, absorbed in the delightful task of making the acquisition of knowledge delightful. It is in this aspect of his character that 'Father Pestalozzi' is best known and best remembered by his own pupils, and those who have learned from them to love him. But it must not be forgotten that along with all the simplicity and gentle enthusiasm of a village dominie of the old school, Pestalozzi was gifted with a profound and original insight into what may be called the 'metaphysics' of education, and that he speaks when he addresses the world at large with all the authority of a great thinker, and a full confidence in the inspiration of genius.

It was, indeed, a rare combination of gifts! The famous writers on education who preceded him had been, for the most part, philosophers and theorists, and had left to others the practical task of carrying their principles into effect. His own master, Rousseau, after elaborating a scheme for the education of an imaginary son, 'Emile,'* in such affectionate and touching detail, had allowed his own children to be brought up in a foundling hospital. Pestalozzi's strength lay in the two extremes—in an instinctive knowledge of the way to win the confidence and the affections of the individual child, and in deep and far-reaching research into the abstract principles of the science of human culture. To revert to our illustration of the architect, Pestalozzi may indeed be said to have understood the composition of a brick and the way to handle it; in planning lofty and enduring thought-edifices, he was in his element still; but between moulding bricks and designing palaces there lies a whole region of practical activity, skill, and knowledge requisite for success, and in this region he was no better than an old woman or

* See page 3.

a child.* We have his own confession that 'in spite of his grand ideals embracing the destinies of the whole human race, he did not possess the knowledge and ability requisite for conducting a village school.' His life was therefore a succession of failures and disappointments, notwithstanding his rare natural endowments and his single-hearted devotion to the highest and most unselfish objects.

It is important to bear in mind the causes of Pestalozzi's ill-success as a schoolmaster, because that ill-success has brought discredit on his system, and given rise to the idea that it is unsound, or at the best, unpractical—a charge which is sufficiently rebuked by the fact of the survival, or rather the successive revivals, of his principles. On the manner of teaching particular subjects he had little influence, but he compelled the educational world to revise the whole of their task, to take into their purview the ultimate destiny of man and the means of leading him from his youth upwards straight towards that destiny. 'I find the battle raging,' says Pestalozzi, 'about particular and isolated systems of instruction; the mind is filled with fragments of truth, while the very spirit of truth itself is quenched; we have forms, not so much of thinking, as of verbal expressions about what has been thought—forms which suck the blood out of good sense, like a marten that fixes itself on the neck of a poor dove. I put to myself the question, "What would you do if you wanted to give a single child all the theoretical knowledge and practical skill which he requires in order to attend properly to the great concerns of life, and so attain to inward contentment?"'

This passage, taken alone, might almost lead us to suppose that Pestalozzi took such a view of the objects of education as might have commended itself to the mind of an Epicurus or an Antonine, and I have quoted it partly with a view of correcting that impression, and partly because it forms a fitting introduction to the main topic of this article.

It is commonly said, by those who have undertaken to expound the 'Principles of Pestalozzi,' that '*the first of those principles is that education must be religious.*' Now it is quite true that, in common with most men of reflection and intelligence, Pestalozzi held that education without religion loses half its depth and value, and more than half its moulding influence and penetrative power, but to say that religion was 'the leading principle,' or even a 'prominent feature' in his system, involves a grave misconception. Nor would it be quite true, though perhaps it might be nearer to the truth, to say, as some have said, that Pestalozzi was an enthusiast, whose enthusiasm took the form of subordinating everything to intellectual and moral culture; that religion was looked upon by him as 'subsidiary to that end,' and that his endeavour was to 'apply Christianity to the business of education.' The fact is that with him religion is an antecedent condition, a presupposed element, apart from which education would be useless or impossible. It was not so much that religion was to be taught, as that everything was to be taught religiously. Thus, for example, the lessons in natural science and history were to be of such a character, that the child himself could not fail to *infer* the necessity of a Final Cause and an overruling Providence. The works of God were to be successively presented in such vivid and attractive colours to the mind of the learner, that childish wonder should gradually brighten into admiration, and admiration warm into love. And 'there were to be not only religious lessons, but religious influence, and religious example; religion in spirit, in aims, in methods, in associations, in principles, in practice.'

All this is as it should be, but here again Pestalozzi's actual practice fell lamentably short of his ideal. At Yverdun, if we are to believe the testimony of more than one of his own pupils, religion was far too much 'presupposed,' and too little inculcated. Moreover the religion which is said to have 'pervaded the institution' was a religion of the feelings, ignoring the corruption of human nature, ignoring doctrine, almost ignoring Scripture, and deriving no strength or authority from church tradition on the one hand, or from sacramental grace on the other. In fact, Pestalozzi's own religious views were for a long period of his life dim and unsettled in the extreme, and though they cleared and brightened with his advancing age, they were never wholly free from the transcendentalism and indefiniteness which are supposed, rightly or wrongly, to be the characteristic of Teutonic Protestantism. With 'Father Pestalozzi,' as with the aged survivor of the twelve Apostles, religion seemed to resolve itself into the single element of love; but, unlike him, Pestalozzi believed in a natural birth-tendency in the child to what is good and holy, requiring only to be protected in its development from the corrupting influences of the world.

Allusion has already been made to his favourite theory that all education is founded on the relationship which subsists between the infant child and the mother. 'The feelings of gratitude, confidence, and love, in the child towards the mother gradually unfold themselves, and are at a later period transferred by the child, on the admonition of the mother, to God.' To this Dr. Mayo eloquently adds:—'The great means to be employed in moral development Pestalozzi held to be love. The mother's love draws out the child's love; the mother's care and tenderness awaken the first dawnings of faith; the child feels safe in her arms; he confides in her word; what she says he believes, and her will is the law to which he yields, and which he obeys. Thus it is in the mother's arms that the moral character is first developed, and moral education passes its first stage. Rightly to direct and exercise the nascent faculties and sentiments is the next point, and here, God Himself, our Heavenly Father, as early as possible, must be presented as the first object of love, His superintending Providence as the object of faith, and His will as the rule of life.'* A beautiful, we will not say, an *ideal* picture—for, thank God! the experience of most of us will testify that it can be, and has been, realised; but it presupposes the mother—the average mother, be it remembered—as pure and innocent as the new-born child, enfolding it, like an angel, under her wings, and enshrining it safe, in the sanctuary of an unruffled bosom, from all the coarseness and defilements of the outer world. Pestalozzi,

* Speaking of the intended opening of a new educational institution, 'I,' says he, 'was to represent the abbot of the monastery; really, in certain respects, I was more fitted to be the donkey, or, at least, the sheep of the monastery than the abbot. My friends, I speak plainly.'

* In the 'Evening Hours of a Hermit' (see page 67), Pestalozzi says, in language of real beauty, though perhaps of questionable orthodoxy: 'Faith in God is the pure sense of simplicity—the ear of Innocence listening to the voice of Nature proclaiming the Fatherhood of God.'

however, always regarded this idea with peculiar affection, as the first and best of his 'discoveries.' He says, 'I should not anticipate half the consequences for the real benefit of mankind as long as our system failed of extending to the earliest stage of education; and, to succeed in this, we require the co-operation of the most powerful ally of our cause, so far as human power may contribute to an end which Eternal love and wisdom have assigned to the endeavours of man. The object of our ardent desires will never be obtained but through the assistance of the mothers.' Upon this passage, a well-known English Pestalozzian* observes, 'The estimate which Pestalozzi formed of this "prize," the tenacity with which he held it, and the place which he assigned it in his system ought to be thoroughly realised.' It took that undivided possession of his mind which a familiar thought will sometimes acquire from a novel combination. It inspired him with the most sanguine hopes; it was from that moment the nucleus, the luminous centre of all his efforts, and the foundation of his system of moral influence and moral elevation. But in time Pestalozzi became dissatisfied here, and he then made his final discovery. He would carry the parental feeling into the schoolroom, and convert the schoolroom into a home. He saw that the family was the original school—God's model school in the beginning of the world. The trainers of children according to the order of nature are their parents, their brothers and sisters. 'And depend upon it,' he came to assert, 'just so far as we fail to conform the school to a family in spirit and character, it will be imperfect, it will bear the impress of human, not of divine wisdom?' We are justified then in saying that it was one of the first principles of Pestalozzi's system that all *education must be essentially of a parental character.*

(2.) Had we been strictly following the order of importance, the foremost place among Pestalozzi's principles should undoubtedly have been assigned to the next axiom, or 'discovery,' as he would perhaps have called it; which, in fact, underlies all the rest, and has done more to revolutionize our modern systems than the whole of them put together; namely, *All education must be founded upon a knowledge of the nature of the child, and must follow the natural order of the development of the human faculties.* The artist must be acquainted with the subject-matter of his art, which, in the case of the educator, is the mind of childhood; and 'the study of the mind must form the basis of the science which aims at developing it.' And the true teacher must be not only a mental analyst, but a student of character; for in different individuals tastes and faculties are developed in a different order, and it will be necessary for him to know when to apply to each of them encouragement, or guidance, or restraint. The mind is a living organism with laws of its own, for its growth, nutrition and development; its treatment must be in harmony with these laws. The physician has long since discovered that he can only assist the efforts of nature; the cultivator, that he can create nothing in, can add nothing to, the plant, but only contribute to its proper development by protecting the tender germ from all injurious influences, and by supplying it with the nourishment best suited to assist its growth. So it is with the cultivator of the mind;—and therefore, in selecting the proper nutriment for it, he should attach their relative importance to the different subjects of elementary instruction, not so much for their own sake as for the educative power which they severally possess; he should regard the mind of his pupil not so much in the light of a receptacle for knowledge, as of an instrument which can be made more or less perfect for the acquisition of knowledge for itself.

(3.) The concluding clause of the last Pestalozzian axiom may best be taken in close connection with the next, namely, that *all education must be founded on observation.* Imbued with the materialistic philosophy of the French school, Pestalozzi held strongly, perhaps too strongly, with our own countryman Locke, that *all* human knowledge is derived from the senses. The powers of perception were, therefore, what was first to be cultivated, for the senses themselves cannot be developed without education; we must be taught how to feel, to see, to touch, and to hear; and the child's best first text-book is the world. Examples must be drawn from familiar objects; things must be learned before words; facts and qualities must be apprehended before we attempt to form, or even to learn, definitions. All knowledge is comparatively worthless which is merely bookish and verbal, and not based upon actual experiences, which may be acquired either by the intelligent observation of the individual, or by an abridgment of the natural process, *i.e.*, by a vivid and methodical presentation of the facts to the learner's mind by a skilful teacher. 'In book-learning there is always a danger that the thing signified may not be discerned through the sign. The objects of a child's instruction should constantly be brought under its eyes. So Pestalozzi was careful to devise lessons on 'objects,' in which, by actual contact with the sense, the children were led to discern qualities which they afterwards described in words. To the young, the truth bare before the sight, palpable to the touch, embodied in forms which the senses realize, has a charm which no mere *words* can convey, until they are recognized as the *sign* of the truth which the mind comprehends. In all that relates to the external world the best book is nature with an intelligent teacher. The master who neglects his opportunities of satisfying the intelligence of his pupils on anything that can be made obvious to the sense, must be content to find that when his lessons rise to abstractions he will be gazed upon by vacant faces. The mind will refuse a lively confidence in general truths when it has not been convinced of the existence of the particular facts from which they are derived.'* Thus, then, the teacher, having laid a foundation of fact, apprehended and tested by the senses, advances from the known to the unknown, from the simple to the general, from the concrete to the abstract, never moving a step forward till the preceding foothold is secure,—and the pupil, following his guidance, and having no false steps to retrace, is enabled, without straining his faculties, to arrive at results which might otherwise have been difficult, or slow, or impossible of attainment.

Lastly, *All education is imperfect without due attention to the training and development of the physical powers.* The faculties of the mind are often clouded by bodily disease or by confinement, or even by want of

* Mr. Dunning.

* Sir James Shuttleworth.

proper exercise. Hence the importance of providing suitable apparatus, and setting apart regular times, for gymnastic exercises; of attending to ventilation, light, temperature, wholesome food, and proper clothing—it remained for the English Pestalozzianism of the future to add,—*above all, to cleanliness.*

Such, in rough outline, are the main features of the system of Pestalozzi—the development, natural, progressive, and harmonious, of the intellectual, moral, and physical powers, in an atmosphere of mutual trustfulness and simplicity, under the sunshine of sympathy and love.

If it be asked, as it is fair to ask in the case of a man so respected and renowned, what permanent benefits has Pestalozzi conferred upon mankind? it may fairly be answered—first, that though he may not have been the actual discoverer of the great truths which he enunciated, they were, with him, the fruits of original research. He was the first to popularise them, to bring them down to the public schoolroom, and apply them for the improvement of the masses, and he is, therefore, justly entitled to be called the father of Poor School Education. Again, 'he was the first to define fully and clearly the work of the schoolmaster, to give him the highest aim, and bid him measure his modes of education by it, to inspire him with the right spirit, and enable him to proceed in his work with all the certainty of the light of the science, and give a reason for every part of his procedure.'* Once more, he called attention to the fact that education, to be successful, must aim at assisting the natural expansion of the innate powers of the mind, and this in their proper order of development—that perception, being the earliest born of these powers, must be the first to be cultivated. If he failed to see with sufficient clearness that some truths are in their nature axiomatic, self-evident, and intuitive, and some must rest on authority and the testimony of others, he did good service in making it clear that the great mass of human knowledge is derivable from observation, and only so far trustworthy as it has been, or can be tested and verified by experiment. Lastly, he inculcated by reiterated precept, and still more by example, an almost unlimited belief in the educative power of patience and self-devotion, of trustfulness and sympathy. It is no exaggeration, but the literal truth, that he gave his life for the lambs of the flock.

It is easy enough to find faults in his views, and to call them, as some have done, unscientific, one-sided, and even mutually contradictory; but those who have any acquaintance with the Elementary Schools of to-day will hardly need to be told how completely those views have interpenetrated our modern system, and how beneficial their influence upon it has been. Those results, indeed, it was not granted to Pestalozzi himself to see. Like the dying Lawgiver of Israel, he had led a younger generation to the borders of a Promised Land, into which he was not permitted himself to enter,—and lay down to die amid the apparent collapse of all his undertakings. But he found his consolation in the unshaken hope of the wide future expansion and dissemination of his ideas, in the 'Pisgah-prospect' of the rich inheritance which lay before those who had followed him faithfully through the stony wilderness of his disappointed career. There is, perhaps, nowhere to be found a more affecting memorial of a crushed and bleeding, but still indomitable faith, than the following passage from a letter of Pestalozzi's, which was found among the papers of a friend: 'Let me now for a moment forget my aim and my labours, and abandon myself to the melancholy which comes over me when I remember that I still live, though I am no longer myself. I have lost everything, I have lost myself: nevertheless Thou, O Lord, hast preserved in me the longings of my life, and hast not shattered to pieces before my eyes the aim of my sufferings, as Thou hast shattered the aims of thousands who have corrupted themselves in their own ways. Thou hast preserved to me the work of my life in the midst of my own ruin, and hast caused to arise upon me in my hopeless declining age an evening brightness, and the sight of its loveliness outbalances the sufferings of my life. Lord, I am not worthy of the mercy and faithfulness which Thou hast shown me. Thou alone hast had pity on the trampled worm; Thou alone hast not broken the bruised reed; Thou alone hast not quenched the smoking flax; and hast not to the latest period of my life, turned away Thy face from the offering, which from childhood, I have tried to bring to the forsaken in the land.'

* Mr. Dunning.

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

IT is astonishing to see how strong the desire *to make* something or other 'beats in the breasts' of boys. They long to be employed in *doing* something in connection with every lesson that is given. The children seem to have a dislike to sitting still in the desks while the teacher is engaged in performing all the experiments himself at the table. I am afraid this feeling on part of the boys is not sufficiently taken advantage of by us teachers. A short time since a quantity of clay was dug up near the school. Juvenile brickmaking at once commenced. On nearly every doorstep young Israelites were busy at work fashioning bricks and other articles, without either taskmasters or straw; all for the mere love of the thing. They brought some of their work to show me. I at once sent out for some lumps of clay, procured a board, and shaped the plastic material into a landscape, consisting of a range of mountains, plain, table-land, island, inland sea, river basin, etc. Then I told the boys to try and make something like it themselves at home. Brickmaking declined. Art advanced a step. For several days the youngsters continued to bring in more or less artistic representations of a landscape to illustrate geographical terms. They 'made the hills also.' That year the second standard passed well in geography. In fact H.M. Inspectors actually questioned the boys from the clay model. The only drawback was when I found that the young artists proceeded, in time, by the aid of their models, to illustrate things too exalted for them; for, in imitation of Milton's terrific battle of the gods, they tore up the solid hills and hurled them at each other.

It is well to get the boys in Standards V. and VI. to make some simple contrivances to illustrate the mechanical powers. They will, of course, construct their models very roughly; never mind that. A boy will be immensely delighted at being called upon to come to the table, explain his apparatus, and work out some result.

In last month's PRACTICAL TEACHER I gave the outline of the first lesson on the lever, and led the boys to the conclusion that the power applied bears the same relation to the weight or resistance to be overcome, as the length of the weight-arm bears to that of the power-arm.

In the next lesson I proceed to show the other kinds of lever, viz., 1st, when the weight is between the power and the fulcrum; and, 2nd, when the power is between the weight and the fulcrum; the relationship of the several parts to each other in the *three* kinds of levers being always expressed by the proportion:

$$P : W :: \text{w.-a} : \text{p.-a.}$$

to maintain equilibrium. After getting from the boys a good many examples of these various levers, I go on to show the correction necessary when taking the weight of the lever itself into account. This is easily seen in principle by means of the apparatus shown in last month's issue of the PRACTICAL TEACHER. The lever (Fig. 1) weighs exactly 2 lbs. Now if its centre of gravity be placed, say, three distances from the fulcrum, a weight of 2 lbs. on the other side of the fulcrum at three distances will balance. Two or three experiments of a like nature will easily make it clear to the boys that the whole weight of the lever may be considered as collected at its centre of gravity. The boys may now proceed to work examples, thus: If the weight = 20 lbs.; power-arm = 6 ft.; and weight-arm = 1½ feet; find the power?

$$P : W :: \text{w.-a.} : \text{p.-a.}$$
$$P : 20 :: 3 : 12$$
$$\therefore P = \frac{20 \times 3}{12} = 5 \text{ lbs.}$$

The following is an outline of the first lesson upon 'pulleys.' The apparatus stands upon the table in front of the boys.

Has any boy ever seen men lifting things by means of a pulley? Ans.—I have. I saw a man pulling a basket of bricks to the top of a house. I saw some men raising the mast of a barge in the canal. I saw some men getting great boxes out of a ship at London Bridge. Smith, take this in your hand (I give him the pulley S (Fig. 2). What is it? Ans.—A pulley. What is it made up of? Ans.—A wheel in a frame. Can you say anything about the wheel? Ans.—It has a groove in it? Why? Ans.—For the cord to run in. What is there at the lower part of the frame? Ans.—A hook. What is the difference between this pulley (Fig. 2, T) and the one Smith has been handling? Ans.—It is fixed in the frame. If then I call this, T, a fixed pulley, what would you call that, S? Ans.—A movable one. Jones, come and stand on the table. Unhook the cord, T S, from the frame, and take it away from the pulley S. Now put on a 4-lb. weight at P: see what weight on the other end of the cord will balance this. Ans.—4 lbs. Very well. You see then that as 4 lbs. just balances 4 lbs., there is no gain of power by using a fixed pulley. Why do people use it then? Ans.—Because a man can raise a weight to a good height when he stands upon the ground. If he did not use the pulley, how would the man get the basket of bricks that Embery spoke of to the top of the house? Ans.—He would have either to carry them up, or go to the top of the house and pull them up. Just so; and if he did the latter, in what direction would he pull? Ans.—Upward. But *with* the fixed pulley, in what direction does he exert the force or power? Ans.—Downwards. Very good. Cox, write on the board, 'With a fixed pulley there is no gain of power but only a change of direction' Jones, you can go to your place; French, come out: stand on the table; take this pulley S, pass the cord round it, and hook the cord on to the top of the frame. Now put 2-lb. weight on P: see what weight you must place on the hook at the bottom of this movable pulley S in order to balance. Ans.—4 lbs. Very well; and what part of 4 is 2? Ans.—One-half. Cox, write on the board, 'With one movable pulley the power equals ½ the weight.' Again, French, take off the weight from S; take another movable pulley, R, put the cord on to the hook of S, pass it round R, and hook it up to the top of the frame. Now place a 4-lb. weight on to the hook of R: see what weight at P will balance. Ans.—1 lb. Good; Cox, write on the board: 'With two movable pulleys the power equals a quarter of the weight.' Again, French, take the 4-lb. weight off R, put a cord on the hook, pass it round another movable pulley, Q, and loop it on to the top of the frame. Now hang the 4-lb. weight on to Q (*i.e.* O in Fig. 2); see now what weight a P will balance. Ans.—A half-pound. Exactly so. And what part of 4 lbs. is a half-pound? Ans.—One-eighth. Cox, write on the board: 'With three movable pulleys, the power equals one-eighth of the weight.' Thank you, Cox. You can both go to your places. Tell me what power of 2 is 4? Ans.—The second power. And what power of 2 is 8? Ans.—The third power or cube. Yes. I am now going to rub out what is on the board, and write it down rather differently.

$$\text{With 1 mov. pul. } P = \frac{W}{2}$$
$$\text{,, 2 ,, ,, } P = \frac{W}{2^2}$$
$$\text{,, 3 ,, ,, } P = \frac{W}{2^3}$$

Now can any boy tell me what the power would equal if we had 4 movable pulleys? No answer. Well, look; what is the denominator of the fraction with one movable pulley? Ans.—2. Yes; and we might call that 2 to the first power. What is the denominator with two movable pulleys? Ans.—2 to the second power. (A boy putting up his hand; then several boys). Well? Please, sir, I can tell what it would be if we had four movable pulleys. Could you? What? Ans.—The power would equal the weight divided by 2 to the fourth power. You are quite right. (Another boy.) The power of 2 always equals the number of movable pulleys. Yes, Drayson, you have just hit upon what I wanted. If therefore we let 'n' stand for the number of movable pulleys, come and write on the board what the power would equal in every case. (Drayson writes: $P = \frac{W}{2^n}$.) Very

well. Work this sum, Drayson; if the weight is 120 lbs. and there are three movable pulleys, find the power?

$$P = \frac{W}{2^n}; \; P = \frac{120}{2^3} = \frac{120}{8} = 15 \text{ lbs.}$$

You may now take out your exercise books and copy down what is on the board. Copy Drayson's sum as well.

(To be continued.)

How I Teach Swimming.

BY THOMAS GARDNER,

Member of the London Schools Swimming Club.

OF all my school recreations none is more enjoyable and serviceable than the meetings of the Swimming Club. Of its special use in physical training Dr. Carpenter has already spoken in this journal, and I am looking confidently for further words of commendation from the same able pen.

I shall better illustrate 'How I Teach Swimming' by addressing myself to my club or swimming class.

Raising my eyes from my writing, I look out upon a pretty little lake, embowered in shrubberies and plantations. Two islets crowned with noble trees divide its waters. Round and between these green islands light boats are propelled by oars, skimming or splashing according to the skill of the oarsmen. All the year round swans are sailing upon its quiet surface with the perfect grace which accompanies perfect command.

And yet, boys, I am not chatting with you from the 'Lake District,' but from a well-known parish of the largest city in the world. This pretty sheet of water, which is really a greater pleasure to me and mine than we can express, is, in fact, one of three lakes in one of our London parks.

To these lakelets add the numerous enclosed swimming baths, and that noble institution, 'The London Schools Swimming Club,' which is willing and waiting to tell all London boys and girls where and how to swim, and I really begin to think there can be no excuse for any young Londoner, who, at the close of the summer of 1882, has not commenced to practise this useful and healthy, and therefore noble, art. As for my hearty young friends in the country, there's not a single town boy excusing himself for his ignorance in this important matter, who is not perfectly sure that you have every convenience the heart could desire.

With swimming some of my very merriest memories connect themselves, and just as my eyes are refreshed, whenever my pen gives them a minute, by seeing the sun glinting through the trees on the pretty lake, so my mind as gratefully recalls these happy water feats and freaks, these swims far and near, in rivers, and lakes, and seas. Now I am again, in fancy, breasting the tiny waves round Helen's Isle, celebrated by the pen of your favourite writer, Sir Walter. Now, after a long warm pull out from shore, I am taking a header into the clearest, b'uest water of the Mediterranean. Now again, nearer home, I am riding on the great storm-waves in the Channel, pitying, as I am borne aloft on a wave-crest, the crowds on the beach who have vainly attempted to dash through the heavy surf. Now I am again, with strong and steady stroke, crossing that most beautiful of Swiss lakes, Lucerne, proud of my two miles' swim under the shadow of the Alps. Nor will my thoughts come home again till they have dwelt for a moment upon a rare battle waged with a torrent in the Pass of St. Gothard.

Better still is the thought of my own and others' lives saved, and strength and vigour daily increased by the regular morning plunge into the little lake before my window.

Really, boys, you *must* learn to swim. You must no longer be without this added pleasure, this increased assurance of your own and others' safety.

You 'have tried and failed'? Be plucky and persevering, and try again. You *will be* men, and overcome all obstacles to your success in life? I heartily hope you may, but be men *now* in this matter. I repeat, swimming is a grand thing, is the best possible exercise, and the most exquisite pleasure, bracing and enlivening both body and mind. By a determined will and persistent effort—if you find it is required—gain this good thing. At the 1880 meeting of the London Schools Swimming Club, two lads from my small school carried off the fourth and eighth prizes, and proud enough they were to receive them from the hands of a Royal Duke; while at the last competition one of my most regular and persevering pupils fought his way through heat after heat to the coveted position of champion for the year; the competitors on each occasion numbering between two and three hundred. But far truer encouragement for me as a teacher, and for you as learners, is afforded by the fact that not one whom I have presented for competition has failed to obtain his swimming certificate. What hundreds have done, thousands can do. Make a trial in the present warm weather; or if you have failed, try again; and in this column, kindly placed at our disposal, I will give you the very best and most practical help that my pen can afford.

First Lesson.

'Well done, lads! all here but Jones, and the chimes from St. Mark's announcing the hour of seven, with dear old "Home, Sweet Home." Oh, Jones, Jones, you'll learn as little of swimming as of anything else if you are not more punctual. Is this not as pretty a little lake of clear fresh water as one need wish—better than the best covered bath for such hearty lads? Nay, Smart and Quickly, not quite so fast. You must not remain too long in the water on your first visit, and I wish to show you how easy the whole thing is, so keep your clothes on till I have plunged in; then undress as smartly as possible, watching my movements at the same time.'

While undressing all are standing round eagerly listening to my hints on diving. Fortunately we have a long, broad plank attached to wheels, which is pushed out till plank and water are at the same level. A still longer plank at right angles to the first does duty as shaft and running board. After a lesson or two how that long elastic plank and diving board will vibrate as the lithe, happy forms run and leap into the lake. On this first occasion, however, they are instructed to walk on the diving board and attempt a standing dive.

As I am to be their exemplar in all things I, too, must deny myself the usual rush, and, standing on

the plank, put into practice the hints I have just given. I need not demand attention, all are intently observing, as I bend my body well over my knees which are bent at right angles, and with palms together extend my arms straight before my head and towards the water. Very deliberately, that all may have ample time for observation, the head and hands are brought nearer and nearer to the water, until the preservation of equilibrium becomes a difficult problem. I then quietly slide into the water, the feet remaining on the platform as long as possible. No sooner am I in the water than, according to instruction previously given, my back, head, and hands, before curving and pointing downwards, are bent upwards, and my head is out of the water again almost before the feet are in.

This was to be the signal for undressing, which operation at once rapidly proceeds, while I introduce to the young gentlemen's notice some of the simpler water-feats. 'Oh, Smart! how easy!' says Trickster. 'Master's simply lying on his back and doing nothing at all; there now, he's swimming on his chest and getting along, though arms and legs move quite slowly, and see, now he's on his side gliding through the water at a rare pace. Oh! nothing could be easier.' And down goes Trickster on the grass, trying all the strokes at the same time, much to his own satisfaction and his companions' amusement. Fisher, Codling, and Waterman, three of last season's pupils are undressed first, and join me for a few moments, before the rest receive orders; the fresh men getting encouragement and confidence from seeing their playmates almost as much at home in the lake as their master.

All are ready, Smart and Trickster quite impatient for their first attempt.

'Now, lads, just a word. Trust yourselves entirely to us. We shall *play no tricks* with you. My young assistants will be just as careful as myself in that matter. I should like you all to dive in from the plank. Smithers and Spratling, jun., a little nervous? Well, run in sharply, and well wet your head. We must go and see that the divers come to their feet comfortably.'

Those first 'dives' could only by special courtesy be so called. Fat, heavy Slocomb plumped into the water with wondrous sound and splash, while Trickster, after exaggerating my diving posture, and adding a funny little jump, altogether unauthorised, turned a complete somersault, and fell upon his back, far too much flurried to try the strokes he had been practising on the grass.

The 'divers' being put upright again—Slocomb being urged to try and bend his body, and Trickster not to twist and throw himself about so wildly—we promise a speedy repetition of the diving lesson; and Fisher, Codling, Waterman, and myself betake ourselves to the younger and more timid pupils, and coax and help them into deeper water. The rest are ordered to keep moving while they watch our proceedings, and we give our first lesson on

FLOATING.

I take the most timid, lay him on his back, placing one hand under the centre of his body; bid him extend his arms straight behind his head, with palms turned upwards, the legs lying upon the water together, equally straight, with the toes pointing outward. Now, my last order being obeyed, and the chest thoroughly inflated, my pupil, who is rapidly gaining confidence, is assured that I can scarcely feel his weight. On the gradual withdrawal of the supporting hand he almost floats, unless timidity returns. One of the elder pupils is called, and is surprised to find how little weight he has to support while keeping his junior afloat; and the little man, finding his feet, and having lost much of his timidity, has one good splash, a smart run on the bank, a brisk rub down, and, having rapidly dressed, feels 'as warm as a toast.'

My patient young assistants have been following me step by step, their instructions being accompanied by further hints and assuring words from myself. Our attention is then turned to the bigger boys, and not infrequently one or two can float after the first lesson.

Diving and *Floating* have thus occupied our first necessarily short lesson, which has not been of ten minutes' duration.

Tuesday, Thursday, and Saturday are our mornings for swimming, and Thursday finds my pupils on the bank before the stroke of seven for their

SECOND LESSON.

Even Jones has been so aroused by the enthusiastic reports of progress that he is early as the rest. Looking round, however, I find to my astonishment that Trickster is not with us. Smart, his *alter ego*, had of course called for him, and reported him laid up with a very bad cold. 'He came yesterday morning, sir, and stayed in the water twenty minutes,' is information which at once accounts for his bad cold. Poor Trickster! I assured him three mornings would be quite sufficient for the present, that more than five or ten minutes in fresh water would be more likely to do him harm than good; and now he has very likely robbed himself of several lessons.

Again I and my assistants undress first. I utilize the time thus employed in repeating the diving and floating hints of the last lesson. The greater number dive in, and dive better. The bigger ones try to float unaided, while we rehearse the floating lesson with the younger pupils. This done, they are ready for the next step. Still lying upon the back, and supported as before, they are—having first seen the thing done by all four teachers—told to draw up the legs and strike them out again, and are rejoiced to feel themselves really moving. Then they are taught to sweep the hands round to the side, and afterwards to use arms and legs together. This is quite sufficient for the more delicate lads, who watch the subsequent proceedings while dressing. The more robust, however, remain a minute or two longer, to receive their first lesson on the

BREAST STROKE.

They are taken out from the shore till the water is shoulder-high, and there stand with faces towards land. '*Heads well back between the shoulders;*' '*Spine well curved backwards,*' are the first orders; and as they are of the utmost importance, it will pay to secure for them most careful attention. Here I pursue a method I have found adopted in some German schools of natation, which has this special excellence, that by it a considerable number may be simultaneously put

through a swimming drill. The execution of two orders completes the movement of the arms, while the stroke of the legs is divided into three movements. Insisting on attention to previous instructions as to back and head, and seeing that the arms of all are stretched out, with hands just beneath the surface of the water, the thumbs touching, the palms downwards, I give the orders, '*One*,' '*Two*.' At '*One*' the arms are swept round at full length, till they make a straight line with the shoulders, the elbows being then bent, and the hands brought together under the chin. At '*Two*' the arms are stretched quickly forward to the first position.

During this drill I always find some simply skimming the water in their outward sweep, others ploughing too deeply. Be careful the hands commence the outward sweep just beneath the surface, and strike slightly downwards. Smart and Quickly, who have already almost learnt the stroke, are somewhat inconvenienced by being carried forward and off their feet, and are a little flurried till they find that if they keep cool their feet will quietly take their accustomed places; being on the other hand delighted with this additional proof of the buoyancy of the water, and the assurance that they only want the leg stroke to enable them to swim. But our budding natators have been in nearly ten minutes.

THE LEG STROKE

we therefore reserve for the

THIRD LESSON.

Of course our smaller pupils, who in lesson two were not put through the drill for arms, were carefully watching the process, and can soon take their part with the rest in this comparatively easy feat. And now comes what, in my somewhat extensive experience as a voluntary teacher of swimming, I have generally found the crucial test of a boy's natural aptness or otherwise, and the teacher's patience—

'THE LEG DRILL.'

Our plank is wheeled out a trifle further, or a stout rope is held by three assistants, one in the centre, and one at either end.

With chests upon rope (grasped, of course, by the hands, which are held close to the chest), or better still, upon the plank, and at such a level that the water just covers the shoulders, alumni are ready for orders. 'Backs curved, heads well back,' is repeated, and with legs making a straight line with the body, the feet being some six inches under water, first position for leg drill is taken, and orders '*One*,' '*Two*,' '*Three*,' are given. They have been previously explained. At '*One*' the legs are to be drawn quietly under, with knees widely apart, and toes pointing outwards; at '*Two*' strike out the legs quickly at the greatest possible angle, the toes still pointing well outwards; at '*Three*' bring the legs stiffly and quickly together, and thus return to first position. Some of the pupils will doubtless, during the first attempts, be kicking about with feet in some cases actually out of the water; others have to be told not to strike so deeply. The importance of creating the largest possible wedge of water by striking out at the widest angle, and of utilizing this wedge by bringing the legs smartly together, is especially insisted upon and exemplified. Now are orders '*Two*' and '*Three*' included under '*Two*,' so that *the movements of arms and legs may be taken simultaneously.* This simultaneous drill for arms and legs is proceeded with in the case of the most apt only. The rest indulge in their grand final splash and race along the bank; then while dressing note and criticise the proceedings of the 'first division.'

The more forward lads—amongst whom, of course, are Smart and Quickly, poor Trickster being still away—make a line of horizontal bodies on the plank, and arms and legs are moving so well together that some delicious confusion is experienced, for the chest slips over the plank, and the lads are actually swimming.

Rapidly they are replaced, and secured by a belt, broad and soft, to the plank, and after the orders '*One*' and '*Two*' have been called, and their performance criticised twice or thrice, a good lesson is over. At lesson four the same process is repeated with the more awkward squad, division one receiving more of individual attention. The hand by which they are at first supported is soon not required, or the rope and belt by which others are suspended from the platform is gradually lowered, and at this fourth lesson several lads can swim,—have done much towards acquiring for life this exhilarating and useful accomplishment. Even breathing and a long, steady stroke they will soon acquire, and the smarter, more rapid, and ornamental styles, with tricks and games without number, will follow as a matter of course.

(To be continued.)

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.—(*sums dictated*).

(1) 562 + 784 + 305 + 476 + 247 = Ans. 2374.
(2) 463 + 740 + 857 + 384 + 236 = Ans. 2680.
(3) 5070 − 2087 = Ans. 2983.
(4) 6005 − 3047 = Ans. 2958.

STANDARD II.—(*sums dictated*).

(1) 70,604 + 9,005 + 25,493 + 840 + 68,754 + 5,070 + 7,309 = Ans. 187,075.
(2) 70,650 − 19,949 = Ans. 50,701.
(3) 677,567 ÷ 8 = Ans. 84,695 − 7.
(4) 79,685 × 708 = Ans. 56,416,980.

STANDARD III.—(*sums dictated*).

(1) Add £74 19s. 7½d., 18s. 11¾d., £960 7s. 3d., £8 0s. 5¾d., £409 12s. 9d., 8s. 6¼d., £37 16s. 8½d. Ans. £1,492 4s. 3¾d.
(2) Subtraction:
£600,705 19s. 4¼d. − £10,879 19s. 11d.
= Ans. £589,825 19s. 5¼d.
(3) Long Division:
19,115,680 ÷ 97. Ans. 197,068 − 84.

(4) Question (written on black board): 'A person has 4 five-pound notes in his purse. If he pay the butcher £7 9s. 11d., and the baker £8 9s. 9¼d. what sum will he have left?' Ans. £4 0s. 3¼d.

STANDARD IV.—(*written on black-board and given alternately.*)

A. (1) Reduce 3ac. 2rds. 16pls. to square feet. Ans. 156,816 sq. ft.
(2) What is the cost of 89 tons of coals at 18s. 11d. per ton? Ans £84 3s. 7d.
(3) If a brick weighs 64 ounces, find the weight in tons, etc., of 15,000 bricks. Ans. 26 tons, 15 cwt. 2 qr. 24 lbs.
(4) Two tubs of butter, one containing 2cwt. 84lbs. the other 1 cwt. 3 qrs. 6 lbs., are sold for £20 14s. 4½d., how much is that per lb.? Ans. 9¼d

B. (1) A man bought 39 horses for £1,364 0s. 6d., find the cost of each. Ans. £34 19s. 6d.
(2) What will be the cost of 29,000 feet of gas at 2s. 11¾d. for 1,000 feet? Ans. £4 6s. 4¾d.
(3) How many square feet are there in a field containing 4 acres 3 rds. 12 pls.? Ans. 210,177 sq. ft.
(4) What will be the weight in tons, etc., of 571 bags of potatoes, if each bag weigh 168 lbs.? Ans. 38 tons 15 cwt. 2 qr.

STANDARD V. – (*written on blackboard*).

(1) What will a farmer pay for two fields, one containing 9 ac. 3 rds. 26 pls. and the other twice as much at £3 19s. 0d. per acre? Ans. £117 9s. $3\frac{3}{10}$ d.
(2) If 2 cwt. 3 qrs. 5 lbs. cost 4s. 6d. how many tons can I buy for £13 12s. 4d.? Ans. 8 tons 9 cwt. $14\frac{8}{77}$ lbs.
(3) Bill:
$33\frac{1}{4}$ lbs. of tea at 4s. per lb.
$78\frac{1}{2}$ „ coffee at 1s. 4d. per lb.
$57\frac{3}{4}$ „ cocoa at 1s. 8d. „
$28\frac{1}{2}$ „ mustard at 1s. 10d. per lb.
42 eggs at 3 for 4½d. Ans. £19 11s. 5d.

STANDARD VI.—(*written on black board*).

(1) Multiply 2·564 by 3·048 and divide the result by ·04 × 72·5. Ans. 2·69485.
(2) Find the difference between $\frac{3}{8}$ of $\frac{4}{5}$ of 10 guineas and $2\frac{1}{2} + 3\frac{1}{4}$ of £5. Ans. £25 12s.
(3) If 80 men made a street in 7 days how many men could make a street twice as long in 9 days? Ans. $124\frac{4}{9}$.
(4) If $\frac{3}{4}$ of $\frac{4}{5}$ of a share be worth $£24\frac{1}{4}$, what will be the value of $14\frac{7}{10}$ shares? Ans. £570 7s. $2\frac{2}{5}$d.

Dictation.

STANDARD I.

(1) *Transcription*: Winter has come at last. There are no flowers now in the garden and every leaf is gone from the trees.
(2) *Dictation*: The old mouse ran through the long grass to her hole near the roots of that great tree.—*Royal Readers*, No. 1.

STANDARD II.

At last the fairy, who knew what they thought, was angry with them, and she meant to punish their discontent by granting their wishes, and making the folly of these two little trout an example to all the foolish fish in the world. So one day she called the three silver trout to her.—*Progressive Reader*, *p.* 81.

STANDARD III.

Her attention was attracted by a beautiful little fawn that seemed too young to run about, and which stood timidly gazing at the child with its soft, dark eyes. The girl moved towards it; but the fawn started back, with a frightened look and fled. The child gave chase; but the fawn was soon hid among the tall reads and grass of the jungle.—*Royal Readers*, No. 3, p. 75.

STANDARD IV.

'They saw the vault covered, and the stone fixed down: then, when the dusk of evening had come on and not a sound disturbed the sacred stillness of the place—when the bright moon poured in her light on tomb, and monument, on pillar, wall and arch, and most of all (it seemed to them) upon her quiet grave—in that calm time when all outward things and inward thoughts teemed with assurances of immortality, and worldly hopes and pleasure humbled in the dust before them—then with tranquil and submissive hearts, they turned away and left the child with God.'—*Dickens.*

STANDARDS V. AND VI.

'Amidst the crowd, as it streamed saunteringly along, were two spectators—strangers to the place as was notably proved by the attention they excited, and the broad jokes their dress and appearance provoked from the rustic wits—which they took with amused good humour and sometimes retaliated with a zest which had already made them very popular personages indeed; there was that about them which propitiated liking. They were young and the freshness of enjoyment was so visible in their faces that it begot a sympathy, and wherever they went, other faces brightened around them.'—*Bulwer Lytton.*

Grammar.

STANDARD II.

Write out the nouns, and verbs from your dictation.

STANDARD III.

Write out the nouns, verbs, adjectives, adverbs and pronouns from your dictation.

STANDARDS IV. AND V.

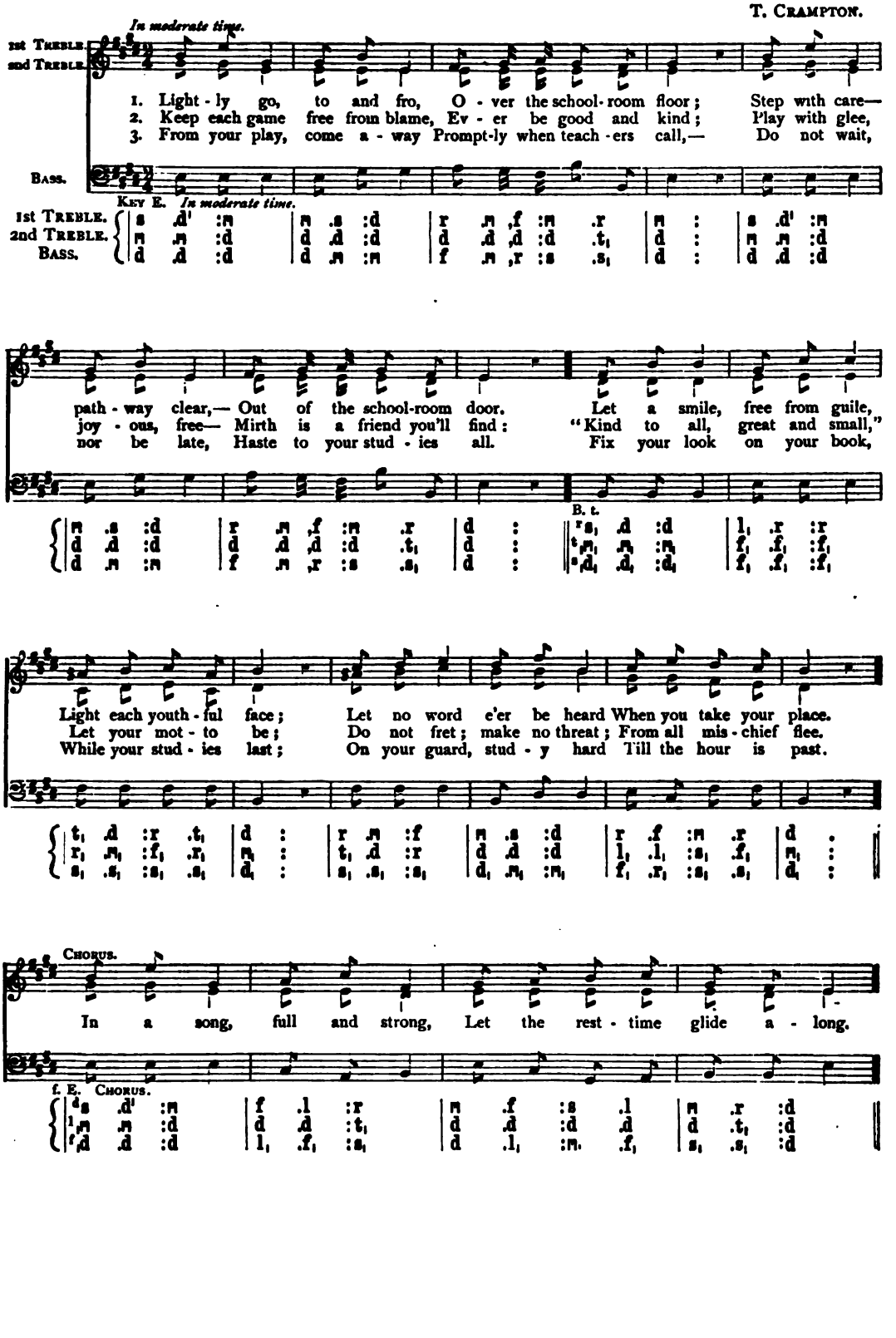
Parsing:
A. The ploughman homewards wends his weary way.
B. The forests with their myriad tongues shouted of liberty.
C. Against the walls of the cottage hung two dry skins.

STANDARD VI.

Analyse and parse:
Look, how the lion of the sea lifts up his ancient crown.

LIGHTLY GO!

T. CRAMPTON.


In moderate time.
1st TREBLE.
2nd TREBLE.
BASS.
1. Light - ly go, to and fro, O - ver the school-room floor; Step with care—
2. Keep each game free from blame, Ev - er be good and kind; Play with glee,
3. From your play, come a - way Prompt-ly when teach-ers call,— Do not wait,
KEY E. In moderate time.
1st TREBLE.
2nd TREBLE.
BASS.
path - way clear,— Out of the school-room door. Let a smile, free from guile,
joy - ous, free— Mirth is a friend you'll find: "Kind to all, great and small,"
nor be late, Haste to your stud - ies all. Fix your look on your book,
B. t.
Light each youth - ful face; Let no word e'er be heard When you take your place.
Let your mot - to be; Do not fret; make no threat; From all mis - chief flee.
While your stud - ies last; On your guard, stud - y hard Till the hour is past.
CHORUS.
In a song, full and strong, Let the rest - time glide a - long.
f. E. CHORUS.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR AUGUST, 1882.

EXERCISE IX.

(1) $abxy$, $abcxyz$, mn, $abcpqr$. (2) a^2, x^7, a^5b^5, $b^8d^4e^3$. (3) xy^2z^2, ab^5c^2x, abx^4y^4. (4) $21a^2b^2$, $90x^3yz^2$, $480m^3n$. (5) x^2y^2z, $-40ab^2c$, $-30a^3b^4c$. (6) $300a^3b^4c^6x$. (7) $4abx$ letters. (8) $240x$ pence.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR AUGUST, 1882.

STANDARD III.

A. 1. 568—8.
2. 607—10.
3. 6522—21.
B. 1. 804—68.
2. 4982—102.
3. 12,363—180.
C. 1. 4194—68.
2. £3816 12s. 3¾d.
3. £4377 8s. 10d.
D. 1. £672 15s.
2. 4239—1277.
3. 124—1664.
E. 1. £2306 13s. 8½d.
2. £8517 2s. 0¾d.
3. 2,061,108 twopences.
F. 1. 4,860,734 farthings.
2. £3973 8s.
3. 2477—110.

ADVANCED EXAMINATION.

1. £187 10s.
2. 8 pears.
3. 615,176,443 farthings.

STANDARD IV.

A. 1. £798 1s.
2. £26,285 0s. 3¾d.
3. £612 10s. 6¼d.
B. 1. £84,262 14s.
2. £273,563 15s.
3. 601,920 inches.
C. 1. 188 ton 6 cwt. 2 qr. 27 lb.
2. 43,197 square yards.
3. £78 15s.
D. 1. £24,797 18s. 11½d.
2. £428 10s. 0½d.—204.
3. £1 8s. 6d.
E. 1. 555,060 seconds.
2. 83d. 3h. 38m. 15s.
3. 17s. 1½d.—1399.
F. 1. 249 cwt. 3 qr. 15 lb. 9 oz. 15 dr.
2. 150 dozen.
3. 16,833 lb. 7 oz. 3 dwt. 23 gr.

ADVANCED EXAMINATION.

1. 2 ton 20 lb.
2. £25.
3. 356 dresses, 5½ yds. left.

STANDARD V.

A. 1. £12 13s. 5½d.
2. £44 3s. 2¾d.
3. £85 3s. 5¼d.
B. 1. £127 1s. 10½d.
2. £347 4s. 10½d
3. £1220 10s. 6¾d.
C. 1. £7285 9s. 8½d.
2. £33,907 19s. 2d.
3. £82 5s. $1\frac{12}{16}$d.
D. 1. £13 2s. 6d.
2. £953,940 0s. 4¼d.
3. £881 19s. $0\frac{7}{16}$d.
E. 1. £10 5s. 6½d.
2. £33 5s. $1\frac{7}{16}$d.
3. £4640 12s. 6d.
F. 1. £2 1s. 5¼d.
2. £27 12s. 6½d.
3. £12,590 8s. 6¾d.

ADVANCED EXAMINATION.

1. £5371 15s.
2. £1 5s.
3. £6981 2s. $7\frac{11}{15}$d.

STANDARD VI.

A. 1. $3\frac{7}{8}$.
2. $3\frac{1}{15}$.
3. $\frac{11}{16}$.
B. 1. 2·88725.
2. ·01606.
3. ·066875.
C. 1. $4\frac{1}{2}$ days.
2. £6 17s. 6d.
3. 4s. $9\frac{3}{10}$d.
D. 1. $24\frac{31}{60}$.
2. £80 18s. 9d.
3. $4\frac{31}{40}$.
E. 1. £16 19s. $6\frac{6}{15}$d.
2. £51 14s. $6\frac{9}{15}$d.
3. ·000005078125.
F. 1. $\frac{3013}{8850}$.
2. $\frac{230}{600}$.
3. £1 10s.

ADVANCED EXAMINATION.

1. $45\frac{3}{4}$ days.
2. $10\frac{6}{11}\frac{6}{75}$ hours.
3. $\frac{23}{24}$.

STANDARD VII.

A. 1. £284.
2. £101 14s. $3\frac{3}{5}$d.
3. $3\frac{1}{11}$ per cent.
B. 1. 327.
2. £4 4s. $9\frac{6}{400}$d.
3. $4\frac{3}{11}$ years.
C. 1. £148 1s. $6\frac{3}{4}$d.
2. £135 19s. $0\frac{3}{4}$d.
3. £869 16s. 8d.
D. 1. £377 15s. $6\frac{3}{5}$d.
2. 649.
3. £27 6s. 4½d.
E. 1. $29\frac{1}{11}\frac{1}{11}$ per cent.
2. £6766 13s. 4d.
3. £7 5s. $7\frac{8}{16}\frac{8}{8}$d.
F. 1. $9\frac{111}{111}$ days.
2. £10 3s. $4\frac{1}{16}\frac{1}{0}$d.
3. $14\frac{7}{11}$ loss.

ADVANCED EXAMINATION.

1. 150 scholars.
2. £25 1s. $11\frac{3}{5}$d. increase.
3. 179·067+yards.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN THE SCHOLAR,' FOR AUGUST, 1882.

STANDARD III.

1. $1\frac{1}{4}$d. × 200 × $7\frac{1}{2}$ × 24 = 45,000d. = £187 10s. Ans.

2. ½ sov. = 120d., and 6 × 120 = 720, no. of pears bought.
720 ÷ 90 = 8 pears each. Ans.

3.

£	s.	d.
701,723	14	8½
60,914	18	9½
640,808	15	$10\frac{1}{2}$ = 615 176,443f. Ans.

STANDARD IV.

1. £600 + £150 = £750, selling price of the tea
£750 ÷ 2½d. = 36,000 oz. = 4500 lbs. = 2 ton 20 lbs. Ans.

2. 25s. ÷ 20 = 1s. 3d., value of one pigeon.
1s. 3d. × 8 = 10s., value of 8 pigeons or of 6 rabbits.
10s. ÷ 6 = 1s. 8d., value of 1 rabbit.
1s. 8d. or 20d. × 300 = 6000d. = £25. Ans.

3. 36 yd. 3 qr. 3 nl. = 591 nls., × 64 = 37,824 nls., total length. And 6 yd. 2 qr. 2 nl. = 106 nls., required for one dress. Hence 37,824 ÷ 106 = 356 dresses and 88 nls., or 5½ yds. left. Ans.

STANDARD V.

1.

	£	s.	d.
1s. 8½d. × 240 × 50 =	1025	0	0
1s. 9d. × 230 × 84 =	1690	10	0
1s. 7½d. × 200 × 70 =	1137	10	0
1s. 10½d. × 180 × 90 =	1518	15	0
	£5371	15	0 Ans.

2. (6s. + 4s. = 10s.) × 20 = £10, and 4s. × 40 = £8, total £18, excess that the men and women in the aggregate receive over a boy's share each. Then £163 − £18 = £150, which, divided by 120, the number of recipients = £1 5s. Ans.

3. Bringing both the areas to half-roods, and, working by simple proportion, we have—

$$\frac{£2170\ 15s. \times 1206}{375} = £6981\ 2s.\ 7\tfrac{11}{15}d.\ \text{Ans.}$$

STANDARD VI.

1. A and B do $\frac{1}{15}$ of the work in a day, and A, B, and C do $\frac{2}{15}$; $\frac{2}{15} - \frac{1}{15} = \frac{8}{228}$ part done by C in a day, hence 228 ÷ 5 = $45\frac{3}{5}$ days. Ans.

2. After a little consideration the question thus presents itself:—'If $1\frac{3}{4}$ miles be made by 50 men in 30 days of 10 hours each, how many hours a day must 52 men work to make $1\frac{1}{4}$ miles in 20 days?' Then by proportion we have—

$$\frac{10\ \text{hrs.} \times 5 \times 50 \times 30}{7 \times 52 \times 20} = 10\tfrac{68}{182}\ \text{hrs. Ans.}$$

3 $6\frac{3}{4} - 4\frac{5}{8} = 2\frac{1}{8} = \frac{17}{8}$; $(8\frac{2}{3} \div 12\frac{3}{5}) = (\frac{26}{3} \div \frac{63}{5}) = (\frac{26}{3} \times \frac{5}{63}) = \frac{130}{189}$; $(\frac{17}{8} \div \frac{130}{189}) = \frac{17}{8} \times \frac{189}{130} = \frac{3213}{1040}$, the first term simplified. $(9\frac{1}{4} \times 3\frac{5}{7}) = (\frac{49}{5} \times \frac{14}{3}) = \frac{686}{15}$; $7\frac{5}{6} + 3\frac{3}{4} = 11\frac{7}{12} = \frac{139}{12}$; $(\frac{686}{15} \div \frac{139}{12}) = \frac{686}{15} \times \frac{12}{139} = \frac{2192}{695}$, the second term. Then $(\frac{3213}{1040} \div \frac{2192}{695}) = (\frac{3213}{1040} \times \frac{695}{2192}) = (\frac{3213}{2096} \times \frac{139}{2192}) = \frac{446907}{4594432} = \frac{63087}{649264}$. Ans.

STANDARD VII.

1. 20+24+26=70 per cent. in first three classes, hence 30 per cent. must be in the fourth class; but there are 45 scholars in this class, hence 45÷30=1½, one per cent. of the scholars, and 1½×100=150. Ans.

2. £3×45=£135 yearly interest before transfer.
£92·5×45=£4162·5, amount received on selling out.
£4162½÷260=16 13/19 cents. of bank stock bought, and £10×16 13/19=£160 9/19 income from bank stock, hence £160 9/19 − £135=£25 9/19=£25 1s. 11 1/19 increase. Ans.

3. 6 ac. 2 r. 20 p.=32,065 sq. yds., the sq. root of which=179·067+yards. Ans.

—o—

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

NO. XIV.—THE HETEROPTERA.

THE *Heteroptera*, or, according to some systems, the *Hemiptera-Heteroptera*, differ from the *Homoptera* chiefly in the structure of the wings, which, in those species that possess them, are of two different textures, the basal portion of each being hard and leathery, while the remainder is membranous and semi-transparent. Hence is derived the title of Heteroptera, which signifies 'different-winged.'

In the *Heteroptera*, the wings slightly overlap when the insect is at rest, instead of running parallel to one another at the suture, as is the case with the *Homoptera.*

Amongst the other distinguishing features of the group, we may mention the form of the body, which is flattened, and not convex, and also the position of the proboscis, which starts from the front of the under surface of the head, instead of from the back.

In many of the *Heteroptera* the wings are scarcely visible, being, indeed, nothing more than mere rudiments of those organs, while in others they are only developed in a very slight degree, and are utterly useless for purposes of flight. In some species we meet with a rather curious phenomenon, the vast majority of specimens being apterous, while an example occasionally appears in which the wings are fully developed.

The *Heteroptera* are sub-divided into two great groups, known respectively as *Gymnocerata* and *Cryptocerata.* The former of these titles signifies, 'apparent-horned,' and refers to the antennæ, which, in the insects belonging to this group, are long, and are easily seen. This is not the case, however, with the members of the second group, in which the antennæ are very small, and are not visible except upon close examination. The title of *Cryptocerata*, or 'hidden-horned,' which has been applied to them, is, therefore, very appropriate.

In Mr. Westwood's arrangement these two groups are termed *Aurocorisa* and *Hydrocorisa.* The former of these two titles signifies 'air-bugs,' all the insects of the group being dwellers either upon the earth or the surface of the water, beneath the surface of which, however, they are not in the habit of living. But the *Hydrocorisa*, or 'water-bugs,' are all inhabitants of the water itself, passing the greater portion of their existence beneath the surface, and only rising occasionally in order to obtain a supply of air.

A very conspicuous member of the former group is the insect scientifically known as *Tropicoris rufipes*, but which possesses no popular title. In common with many of its congeners, however, it is often termed a 'Bishop's Mitre,' in consequence of the peculiar form of the body.

This insect is very common towards the end of summer, and may often be seen resting on palings, etc., or on the herbage by the roadside; the brilliant red spot at the apex of the scutellum rendering it a very striking object. The general colour is brown, prettily mottled with black, while the beak, the antennæ, and the legs are of a bright red.

In common with many members of the group the *Tropicoris* possesses a powerful and singularly unpleasant smell, which, if the insect be handled, will cling to the fingers for a considerable time, in spite of repeated lavations. This disagreeable odour is also transmitted to the substances over which the insect walks, fruit of various kinds being often tainted to such a degree as to be rendered perfectly uneatable.

It is, however, under the control of the insect, which can exude or retain it at will. It is due to a fluid which passes from two small pores in the hinder tarsi, so that if the insect be carefully seized by the sides of the body, in such a manner that the feet cannot come into contact with the skin, it can be handled with perfect impunity.

The odour still clings to the insect for many months after death, and often renders the drawer in which the specimens are contained most terribly offensive to the olfactory organs.

The common bed bug *(Acanthia lectularia)* is also a member of this group. This is one of the apterous species of *Heteroptera*, the wings being only represented by two very small projections in the place of those organs.

This only too familiar insect is not an indigenous inhabitant of England, but is supposed to have been introduced into this country in the course of the last two or three hundred years; from whence, however, we cannot ascertain with any degree of certainty. Once imported, it spread with marvellous rapidity, rivalling the cockroach itself in the speedy manner in which it made its way even to the most remote parts of the country.

When once it has taken up its quarters in a room, the bed bug is a most difficult creature to disestablish, its small size and flat body enabling it to creep into the smallest crevices. Within these chinks are deposited the eggs, some fifty or sixty in number, which are always covered with a kind of varnish which hardens upon exposure to the atmosphere, and so fixes them securely to the substance upon which they are laid.

The most successful method of destroying these disagreeable insects appears to consist in burning large quantities of sulphur in the room in which they have taken up their residence, having previously stopped up every aperture through which the fatal vapour can possibly escape. After a few weeks the process must be repeated, in order to destroy those specimens which have emerged from the egg subsequently to the former campaign.

Passing over a large number of insects, which are of little interest except to those making a special study of the order, we come to the curious group which pass their existence upon the surface of the water, over which they can glide with considerable speed. These

are known in science as *Hydrometridæ*, or 'water-measurers,' and are so called because they seem to measure the surface of the water with their wonderfully long and slender limbs. Popularly they are known as Water-gnats, bearing, as they do, some little resemblance to a gnat from which the wings have been removed. They are to be seen in great numbers in almost every pond, passing along over the surface of the water with astonishing speed.

The fore-limbs do not appear to be employed for purposes of locomotion, but are stretched out in front of the body for the purpose of seizing prey. The hinder legs seem to act chiefly in directing the course, while upon the middle pair falls the task of propulsion.

In many specimens of water-gnats the wings are not developed, but remain in a rudimentary condition throughout the insect's existence. In others, however, they attain their full dimensions, and are quite capable of bearing their owner through the air. Upon alighting after an aerial excursion, the long hind limbs are employed in tucking the wings beneath the elytra.

Water-gnat (*Gerris lacustris*).

Included in the *Gymnocerata*, although not in Mr. Westwood's group of the *Aurocorisa*, are two very curious and interesting insects, each of which will be described in turn.

The first of these is the extraordinary creature known as *Ranatra linearis*, which would by very few people be recognised as an insect at all. In general appearance it is not unlike a gigantic water-gnat, from which insect, however, it differs in the two long bristle-like appendages springing from the end of the body. Its total length, measured from the extremity of the fore-legs, when fully stretched out, to the end of the bristle-like appendages at the tail, is rather more than three and a half inches, while the extreme width of the body is nowhere greater than one-seventh of an inch. The dull brown colour, slender body, and long limbs render the insect very far from conspicuous amongst the weeds of its native pond, and, until it moves, the creature can hardly be distinguished from the stems of the plants amongst which it is resting.

The *ranatra*, unlike the water-gnats, spends the greater part of its existence beneath the surface of the water, progressing by means of the two hinder pairs of legs. The fore-limbs seem to be used for the purpose of seizing prey alone, and are formed more like jaws than legs; so much so, indeed, that they would certainly be mistaken for those organs by any but an experienced observer.

The eggs of the *ranatra* are deposited in a very singular manner, which has been described by a correspondent of 'Science Gossip,' for November, 1879. He says: 'On July 7, I was much surprised to find the leaf of frog-bit exhibiting a most unusual appearance; the best verbal description that I can give of this appearance is, that the floating leaf appeared on the top to possess the antennæ of some moth, to which underneath was attached a small substance, something in shape like a canary seed, but more rounded at the extremities, especially at the end from which these antennæ or appanages spring. The leaf had evidently been pierced, and the appanages thrust through, which, opening into a V-like shape, kept the underneath substance from falling.

'I was much puzzled by these appearances, and being quite ignorant of what they were, called in one or two friends to see them, in the hope of acquiring information; but being unable to get any I then more anxiously watched, and almost came to the conclusion that they were the germs of some botanical production.

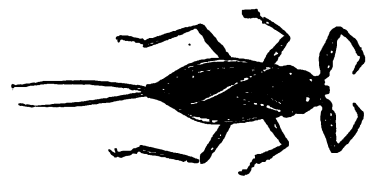
'The leaf of the frog-bit decaying they gradually sank, the same V-like appanage which had kept them in their position now keeping them from falling too fast or from sinking in the soft mud at the bottom of the aquarium; here they remained in a perpendicular position, and were watched from time to time. On August 4th I was delighted to find four young *ranatra* swimming freely about. They were about half an inch in length, and in form so like their parents that it was impossible to be deceived.

'The appearance of these young *ranatra* led to the discovery that the objects on the leaf of the frog-bit which had so puzzled me were the ova of this insect, for I found them all on the bottom of the aquarium quite empty, with an opening in the end between the antennæ or appanages.

'I cannot help thinking what an interesting sight it must have been to have watched the insect depositing the ova, how the leaf must have been pierced, the ova extended, the antennæ—if they may be so called—being thrust through the perforated opening, on which they must immediately have sprung into a wedge-like shape—opening wide at the top—to keep the ova in position.'

The *ranatra* is not a very common insect, but may be found in ponds and ditches in many parts of the country.

Belonging to the same family as the *ranatra* is a very different-looking insect, namely, the common Water-scorpion (*Nepa cinerea*). A very good idea of the general appearance of this insect may be obtained by a reference to the accompanying illustration, in which the flat, leaf-like body, the jaw-like fore-legs, and the appendages at the end of the body are very well depicted. The fore-limbs closely resemble those of the *ranatra*, and are used for a like purpose, namely, that of securing prey.



Water-scorpion (*Nepa cinerea*).

Were it not for the powerful likeness which it bears to the dead leaves and other *débris* found at the bottom of every pond the water-scorpion would find great difficulty in obtaining food, for its motions are far more sluggish than those of the water-insects, etc., upon which it preys. But, aided by its resemblance to surrounding objects, the insect waits patiently until some luckless victim comes within reach, when it is at once seized by the outspread fore-legs, conveyed to the

mouth, and its juices strained by means of the sharp proboscis.

The filaments at the end of the tail serve to convey air to the spiracles, which are placed at the end of the body, when the insect is beneath the water, the extremities of those appendages just appearing above the surface while their owner is altogether submerged. Those of the *ranatra* answer the same purpose.

The eggs of the water-scorpion are of a very singular form, being furnished with seven horn-like projections, arranged in a circle, by means of which they are fastened to the leaves of various water-plants, just as is the case with those of the preceding insect.

Although the water-scorpion almost invariably seeks its prey beneath the water, I know of one case, which came under my personal observation, in which there was an exception to this rule.

While standing, one warm summer's day, upon the banks of a small pond, which had been partly dried by the heat of the weather, I noticed a fly struggling in the mud which surrounded the edge of the water, and apparently in the grasp of some invisible adversary. Upon investigating the matter, I found that a water-scorpion had buried itself in the mud, with the jaws just projecting above the surface, and had seized the fly as it passed along unconscious of the presence of its enemy. The whole proceeding, in fact, bore a considerable resemblance to the mode of capture of prey followed by the ant-lion.

Although a very dull and sombre-looking insect when creeping slowly amongst the *débris* of the pond, the water-scorpion is really quite a handsome creature when the wings are spread in flight. The basal portion of the lower pair, as well as the greater part of the upper surface of the abdomen, are then seen to be of a brilliant red colour, which really renders the insect a striking object.

The water-scorpion is a very plentiful insect, and may be taken in numbers from any weedy pond.

Now we come to the second of the two great groups of *Heteroptera*, namely, the *Cryptocerata*, or those in which the antennæ are concealed from view. The most interesting of these, perhaps, is the common Water-boatman (*Notonecta glauca*), which we will accordingly take as a type of the group.

In the accompanying woodcut the position generally assumed by the boatman when swimming, or resting upon the surface of the water is very well repre-

Water-boatman (*Notonecta glauca*).

sented. In this curiously reversed position the insect passes the greater part of its existence in the water, and may be seen in numbers in almost any pond, resting motionless upon the surface of the water, unless disturbed by the shadow of a passer-by. Sometimes, however, on a fine and sunny morning, the boatman will turn over, and assume a rather remarkable attitude, resting upon the surface of the water with the elytra opened and the wings partially protruding.

The name of 'boatman' is wonderfully appropriate, the insect, in its reversed position, bearing a most striking resemblance to a boat with two long oars projecting from it. And the long hind limbs really take the place and fulfil the functions of oars, being fringed with long hairs, just as is the case with those of the *Dyticus* and other aquatic beetles, in order that they may offer a greater resistance to the water. The term '*Notonecta*' is also appropriate, that word signifying a 'back-swimmer,' and referring to the attitude assumed by the insect when in the water.

The 'feathering' principle, if we may so call it, of the swimming legs, is also quite as strongly marked as in the water-beetles, the limb mechanically turning sideways for the reverse stroke, and so presenting the edge only to the water, through which it cleaves without difficulty.

The respiratory system, too, is of much the same order, the space between the wings and the abdomen forming a kind of reservoir for the reception of air. Thus provided, the insect can spend a considerable time beneath the water without requiring to seek the surface in order to procure a fresh supply.

The wings of the *notonecta* are large and powerful, and are well adapted to bear their owner through the air. The insect is able to take to flight from the surface of the water, which it does as follows: First, diving to some little distance, it reverses its position so as to bring its head upwards; then, swimming rapidly towards the surface, it gives a smart stroke with the hinder legs, and so projects itself a few inches into the air. The wings are then immediately spread, and the insect flies off before it has time to fall back into the water.

(Some years ago, I had a number of water-boatmen in an aquarium. Seeing, to my great surprise, that they took to wing from the surface of the water, I leaned over the aquarium and looked into it. Presently, one of the insects dived, as has just been mentioned, sprang into the air, struck me on the nose, and fell back into the water. I wonder which was the more surprised, the insect or myself.—J. G. WOOD.)

The water-boatman is a very predacious creature, and seems to possess a particular fondness for the water-gnats, which it captures without difficulty as they are resting upon the surface of the water. In a very few moments the body is drained of its juices, and the boatman casts it aside and looks out for another victim.

The proboscis of the water-boatman is very sharp and strong, and is capable of inflicting a rather painful wound upon the fingers if the insect be not properly held. The saliva appears to possess a decidedly poisonous quality, as the wounded finger will swell and ache for hours in a manner which could scarcely be caused by the puncture alone.

Both the larva and pupa of the water-boatman bear a very strong resemblance to the perfect insect, from which, however, they can easily be distinguished by the absence of wings. In the former stage of development these organs are altogether wanting, while in the pupa they are quite rudimentary in size.

Closely allied to the water-boatman are a number of insects included under the generic title of *Corixa*, many of which are exceedingly plentiful in every pond. In habits and general appearance these little creatures closely resemble the preceding insect, from which they may be distinguished by several points of structure, such as the form of the body, which is flat instead of convex, etc.

(To be continued.)

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ANSWERS TO
Pupil Teachers' Examination Paper.
JUNE 24TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. If there was a coin worth 2s. 10½d, what would be the worth of 276 of them?

	£	s.	d.
Value of 276 at £1 each =	276	0	0
" " 2s. 6d. = ⅛ val. at £1 =	34	10	0
" " 0s. 3d. = 1/10 " 2s. 6d. =	3	9	0
" " 0s. 1½d. = ½ " 3d. =	1	14	6
" " ½d. = ⅛ " 1½d. =		5	9
Total value =	39	19	3 Ans.

2. If out of a yearly income of 900 guineas a man gives one-twelfth in charity, and spends on an average £11 5s. per week, what can he save in a year?

	£	s.
1/12 of 900 guineas = 1/12 of £945 =	78	15
£11¼ × 52 = £572 + £13	585	0
Total expenditure =	663	15

£945 − £663 15s. = £281 5s. Ans.

3. Find the cost of 2,834 articles at 17s. 10½d. each, and show two ways of working it.

1st method—

	£	s.	d.
Value of 2,834 at £1 each =	2834	0	0
" " 10s. " = ½ val. at £1 =	1417	0	0
" " 5s. " = ¼ " 10s. =	708	10	0
" " 2s. 6d. " = ⅛ " 5s. =	354	5	0
" " 3d. " = 1/10 " 2s. 6d. =	35	8	6
" " 1½d. " = ½ " 3d. =	17	14	3
Total value =	2532	17	9 Ans.

2nd method—

	£	s.	d.
Value of 2,834 at £1 each =	2834	0	0
" " 2s. " = 1/10 val. at £1 =	283	8	0
" " 1½d. " = 1/16 " 2s. =	17	14	3
deduct total val. at 2s. 1½d. from val. at £ =	301	2	3
and the remainder =	2532	17	9 Ans.

4. How many yards of lace can be bought for £228 12s. 7d. at the rate of £1 15s. for 4¼ yards?

£1 15s. : £228 12s. 7d. :: 4¼ yds. : ?
or or
420d. 54,871d.

$\frac{17}{4}$ yds. × $\frac{54871}{420}$ = $\frac{931807}{1680}$ yds. = $555\frac{407}{1680}$ yds. Ans.

FEMALES.

1. Make out the following bill:—

81 lbs. of tea at 2s. 11d. per lb.
99 lbs. of coffee at 1s. 7½d. per lb.
27 lbs. of cocoa at 1s. 5d. per lb.
243 lbs. of rice at 2½d. per lb.
6 lbs. 8 oz. tea at 3s. 4d. per lb.
18 lbs. of sugar at 4½d. per lb.
1 quarter lb. of cocoa at 1s. 4d. per lb.
21 lbs. of coffee at 1s. 8d. per lb.
3 doz. matchboxes at 1½d. each.

	s.	d.		£	s.	d.
81 lbs.	at 2	11	per lb. =	11	16	3
99 "	" 1	7½	" =	8	0	11½
27 "	" 1	5	" =	1	18	3
243 "	" 0	2½	" =	2	15	8½
6½ "	" 3	4	" =	1	1	8
18 "	" 0	4½	" =	0	7	1½
¼ "	" 1	4	" =	0	0	4
21 "	" 1	8	" =	1	15	0
36 boxes	" 0	1½	each =	0	4	6
			Total =	27	19	8½ Ans.

2. Find the value of 13,789 articles at £81 4s. 1½d. each.

	£	s.	d.
Value of 13,789 at £1 each =	13,789	0	0
			81
" " £81 =	1,116,909	0	0
" " 3s. 4d. = ⅙ val. at £ =	2,298	3	4
" " 8d. = ⅛ " 3s. 4d. =	459	12	8
" " 1d. = ⅛ " 8d. =	57	9	1
" " ¼d. = ¼ " 1d. =	14	7	3½
Total value =	1,110,738	12	4½

3. What is the cost of 118 c. yds. 10 c. ft. 216 c. in. at £1 4s. 10d. per c. yd.?

		£	s.	d.
Cost of 1 c. yd.	=	1	4	10
				118
,, 118 ,,	=	146	10	4
,, 9 c. ft. = ½ cost of 1 c. yd.	=		8	3½
,, 1½ ,, = ½ ,, 9 ,,	=		1	$0\frac{8}{17}$
Total value	=	146	19	$7\frac{1}{2}$ Ans.

4. How many pencil-cases, each weighing 10 dwt. 6 grs., could be made out of 7 oz. 3 dwt. 12 grs. of gold?

10 dwt. 6 grs. = 246 grs.
7 oz. 3 dwt. 12 grs. = 3444 grs.
3444 ÷ 246 = 14 pencil-cases. Ans.

Grammar.

1. 'Come, sister, put your tasks away,
And don with speed your woodland dress,
And bring no book; for this one day
We'll give to idleness.'

Parse the verbs and adjectives in the above.

VERBS.

Come—intrans. irreg., *come, came, come,* imper., 2nd pers., sing., agr. with (*thou*).
put—trans. irreg. *put, put, put,* imper., 2nd pers. sing., agr. with (*thou*).
don—trans. reg. imper., 2nd pers. sing., agr. with (*thou*).
bring—trans. irreg. *bring, brought, brought,* imper., 2nd pers. sing., agr. with (*thou*).
will—irreg. defec. *will, would,* indic., pres., 1st pers. plur., agr. with *we*.
give—trans. verb. irreg. *give, gave, given,* infin. pres. gov. by *will*.

ADJECTIVES.

(1) *your*— pronom. poss. limiting *tasks* and (2) *dress*.
woodland—distinguishing ,, ,, *dress*.
this— ,, ,, ,, *day*.
one—numeral ,, ,, ,, *day*.
no—negative ,, ,, ,, *book*.

2. What is a noun of multitude? Give examples to show what should be the number of the verb agreeing with such nouns.

A noun of multitude, or collective noun, is one that in the singular stands for one collection of several individual things, as *herd, multitude*. In the plural it stands for several such *collections*.
When the noun of multitude conveys an idea of unity, the verb must be singular, as, 'The army was routed.' But when an idea of plurality is conveyed, the verb must be plural, as, 'The French peasantry wear wooden shoes.'

3. Give examples of adjectives both before and after the nouns they qualify.

Before the noun.	After the noun.
He is a *loyal* subject.	He is a man *loyal* to his king.
That is a *deep* well.	The well is six feet *deep*.
With eyes *upraised*, as one *inspired*,	
Pale Melancholy sat.	

Geography.

Answer two questions.

1. Describe minutely the course of a ship sailing along the coast from Liverpool to Gloucester.

Starting from *Liverpool*, the greatest seaport in the British Empire, we sail from the Mersey south past the mouth of the Dee, on which stands *Chester*, with its old walls and covered walks, past *Holywell*, and round Great Orms Head. Continuing south-west, we come to *Conway*, *Bangor*, (Holyhead, the packet-station for Dublin, stands on the west side of Anglesea). We pass through the Menai Strait, which is spanned by two magnificent bridges, and enter Carnarvon Bay, on which stands *Caernarvon*, the largest town in North Wales. Doubling Bardsey Point, we enter the capacious *Cardigan Bay*, on which stand *Harlech*, *Barmouth*, *Aberystwith*, and *Cardigan*. Passing *Fishguard*, we round *Strumble Head*, *St. David's Head*, *Bride's Bay*, and enter Milford Haven, one of the finest harbours in Britain, on the shore of which is *Pembroke*. Beyond St. Gowen's Head, we pass Caermarthen Bay, and rounding Worms Head, we come to *Swansea*, with large copper-melting works, *Cardiff* at the mouth of the Taaf, the chief port for minerals in South Wales. Leaving Cardiff, we sail up the Severn past Newport, Chepstow, and Berkeley, reaching Gloucester, where the river meets the tide.

2. Describe as fully as you can, the situation and character of Penzance, Torquay, Scarborough, Whitby, Rothesay, and Oban.

Penzance stands on the N. W. side of Mount's Bay, and has an extensive pilchard fishery. It is remarkable for the salubrity and mildness of its air.
Torquay is beautifully situated on Tor Bay, is much frequented as a watering-place, and because of its mild climate as a winter residence for invalids.
Scarborough, a seaport town in the North Riding of Yorkshire, about thirty-six miles from York, is the most fashionable watering-place on the N. E. coast.
Whitby, a seaport about twenty miles from Scarborough, in the North Riding of Yorkshire, is a summer resort.
Rothesay, beautifully situated on the east side of the island of Bute in the F. of Clyde, is much resorted to for sea-bathing, and as a winter residence for invalids.
Oban is situated on the west coast of the north part of Argyleshire. The beautiful bay on which it stands is protected by the Island of Kerrera. It is the central point for steamboats trading among the Western Isles, and a great centre for tourists in the summer.

Composition.

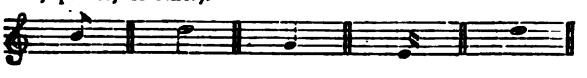
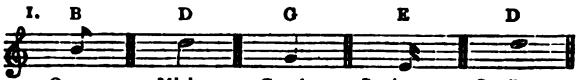
Write from dictation the passage given out by the Inspector.

Penmanship.

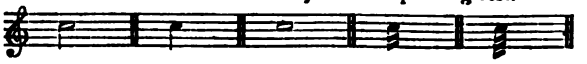
Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.
Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Music.

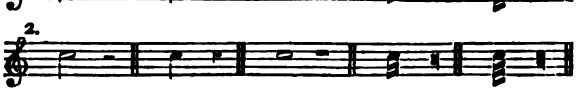
A quarter of an hour allowed for this paper.

1. Write over each of the following notes its pitch name (C, D, *Do, Re,* or other), and under each its duration name (crotchet, quaver, or other).

1. B D G E D

Quaver. Minim. Crotchet. Semiquaver. Semibreve.

2. Follow each of these notes by its corresponding rest.



2.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing four quavers?

3. If we make *one* beat while we sing a crotchet, we must make *two* while we sing four quavers, because one crotchet is equal to two quavers.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. From a field of $12\frac{3}{8}$ acres are taken off three equal portions of $1\frac{7}{40}$ acres each, and also two portions of 2 roods 15 poles each, how much remains?

	ac.	ro.	po.
$1\frac{7}{40}$ ac. × 3 =	3	2	4
2 ro. 15 po. × 2 =	1	0	30
	4	2	34

	ac.	ro.	po.
The whole field =	12	2	16
Deduct	4	2	34
Remainder =	7	3	20. Ans.

2. Explain when and why it is necessary to bring fractions to a common denominator. Reduce $\frac{5}{8}$, $\frac{3}{11}$, and $\frac{7}{12}$ to a common denominator.

In adding or subtracting fractions, it is necessary to bring them to a common denominator, as we can only add or subtract quantities of the same kind or of the same denomination. It is necessary in simple addition or subtraction to place units below units, tens below tens, etc. So in fractions we can add or subtract fourths and fourths, sevenths and sevenths, etc., that is, fractions of the same denomination.

The L. M. C. of 9, 21, and 12 = 252.

Therefore $\frac{5}{8}$, $\frac{3}{11}$, and $\frac{7}{12}$ reduced to a common denominator = $\frac{165}{264}$, $\frac{72}{264}$, and $\frac{154}{264}$. Ans.

3. Divide $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{7}$ of 42 by the sum of $2\frac{1}{5}$ and $4\frac{5}{6}$.

$$(\tfrac{1}{2} \text{ of } \tfrac{2}{3} \text{ of } \tfrac{5}{7} \text{ of } 42) \div (2\tfrac{1}{5} + 4\tfrac{5}{6}) = \frac{1 \times 2 \times 5 \times 42}{2 \times 3 \times 7} \div 6\frac{34}{45} =$$

$$10 \times \tfrac{45}{304} = \tfrac{450}{304} = \underline{1\tfrac{73}{152}}. \text{ Ans.}$$

4. What is the sum of 264 hundredths, 18 tenths, 34 millionths, and 62,584 hundred-thousandths?

264 hundredths	=	2·64
18 tenths	=	1·8
34 millionths	=	·000034
62,584 hundred-thousandths	=	·62584
		5·065874

The sum is 5,065,874 millionths. Ans.

FEMALES.

1. If 9 men can mow a field whose length is 630 ft. and breadth 420 ft. in $1\frac{1}{2}$ days, working 12 hours a day; how many hours a day must 6 men work to mow another field 1,080 ft. long by 840 ft. broad in $7\frac{1}{2}$ days?

6 men : 9 men.
$7\frac{1}{2}$ da. : $1\frac{1}{2}$ da.
630 ft. : 1080 ft.
420 ft. : 840 ft.
:: 12 ho. : ?

$$\frac{12 \text{ ho.} \times 9 \times 3 \times 1080 \times 840}{6 \times 15 \times 630 \times 420} = \tfrac{432}{35} \text{ ho.} = \underline{12\tfrac{12}{35} \text{ ho.}} \text{ Ans.}$$

2. A man owes £3,074 7s. 8d., but can only pay £1,921 9s. 2d.; how much shall I receive in the pound on a debt of £500?

£3074 7s. 8d. : £1921 9s. 2d. :: £1 : ?
or or
737,852d. : 461,150d.

$$\frac{£1 \times 461{,}150}{737{,}852} = \underline{12\text{s. } 5\tfrac{1}{4}\tfrac{1}{8}\tfrac{1}{4}\tfrac{1}{8}\text{d.}} \text{ Ans.}$$

3. A school of 260 children contains 3 boys for every 2 girls; how many scholars are there of each sex?

Ratio of boys to girls = 3 : 2, that is, out of every 5 scholars 3 are boys, and 2 girls.

∴ 5 : 260 :: 3 boys : 156 boys. Ans.
And 5 : 260 :: 2 girls : 104 girls. Ans.

4. 144 men make two miles of sewers 18 ft. deep in 300 days of 10 hours each; how many men would it require to make the same sewers 2 ft. deeper in the same number of days, but working 8 hours daily instead of 10?

18 ft. : 2 ft.
8 ho. : 10 ho.
:: 144 men : ?

$$\frac{144 \text{ men} \times 2 \times 10}{18 \times 8} = \underline{20 \text{ men.}} \text{ Ans.}$$

Grammar.

1. Point out and parse all the pronouns and adverbs in the following:—

'Violent fires soon burn out themselves;
Small showers last long, but sudden storms are short;
He tires betimes that spurs too fast betimes.'—SHAKSPERE.

PRONOUNS.

themselves—compound, personal, reflective, referring to 'fires,' 3rd pers., neut. plur., obj., gov. by *burn*.
he—simple pers., used indefinitely, 3rd pers. sing., mas., sing., nom. to *tires*.
that—simple rel. referring to 'he,' 3rd pers., sing., mas., nom. to *spurs*.

ADVERBS.

soon—adv. of time, mod. *burn*.
out— ,, degree, mod. *burn*.
long— ,, time, mod. *last*.
betimes— ,, ,, ,, *tires*.
too— ,, deg. ,, *fast*.
fast— ,, manner ,, *spurs*.
betimes— ,, time ,, *spurs*.

2. Decline the pronoun 'who,' and state what rule is to be observed in the use of 'who' and 'which.'

'Who' is declined thus: sing. and plur., Nom. *Who*, Poss. *Whose*, Obj. *Whom*.

'Who' is applied to persons only. 'Which' to infants, irrational animals, and things.

3. Write two sentences in which the preposition comes *after* the objective.

(1) Have you seen the man *that* I sent the letter *to*?
(2) This is the person *whom* you alluded to.

Geography.

1. Draw a map of the coast line from Cadiz to Naples. Insert the lines of latitude and longitude.

2. Describe fully the river system of Russia, and show how the courses of the rivers are determined by the nature of the country.

The rivers of Russia are divided into three groups, (1) those which flow into the Black Sea, and the Caspian, (2) those flowing into the Baltic; (3) those which flow into the Arctic Ocean. The rivers flowing into the Caspian are slow and sluggish, owing to the ground being very level. The Volga, the largest river in Europe, rises in the Valdai Hills, 550 feet above the level of the sea, and after a course of 900 miles, terminates in numerous marshy mouths on the N. W. side of the Caspian. It is navigable almost from its source to its mouth, but the navigation is often impeded, owing to sand-banks and the shifting of its channel.

The chief of the Black Sea rivers are the Don, the Dnieper, and the Dniester, which flow through higher lands, along deep channels rather than river valleys. The Baltic receives from Russia the Dvina, and the Neva, on which St. Petersburg stands.

The two largest flowing into the Arctic Ocean are the N. Dvina, and the Petchora.

The courses of rivers in every country are determined by the slope of the land called the 'water-shed' the highest point of which is the 'water-parting.' In Russia the chief water-parting is the highest ridge of the Valdai Hills, a round backed cluster commonly described as of a dome-like form. This group of hills may be compared to a knuckle of land, which turns the rivers in *three* directions, as has been shown above.

History.

1. What sovereigns were reigning in the years 900, 1000, 1100, and 1200?

Alfred the Great was reigning in 900.
Ethelred the Unready „ 1000.
William II. (Rufus) „ 1100.
Richard I. (Cœur-de-Lion) „ 1200.

2. Write out a list of sovereigns of the House of York, and the House of Stuart, with their dates.

HOUSE OF YORK.

	A.D.
Edward IV. began to reign	1461.
Edward V. „ „	1485.
Richard III. „ „	1485.

HOUSE OF STUART.

	A.D.
James I. began to reign	1603.
Charles I. „ „	1625.
(Commonwealth from 1649-1660.)	
Charles II. restored	1660.
James II. began to reign	1685. (dethroned 1688).
William III. and Mary II. „	1689.
Anne „ „	1702-1714.

3. Give the dates of all our kings named Henry, and tell the line to which each of them belongs.

	A.D.		A.D.	
Henry I. reigned from	1100	till	1135	(Anglo-Norman Line).
Henry II. „ „	1154	„	1189	(Plantagenet „)
Henry III. „ „	1216	„	1272	(„ „)
Henry IV. „ „	1399	„	1413	(Lancaster „)
Henry V. „ „	1413	„	1422	(„ „)
Henry VI. „ „	1422	„	1461	(„ „)
Henry VII. „ „	1485	„	1509	(Tudor „)
Henry VIII. „ „	1509	„	1547	(„ „)

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

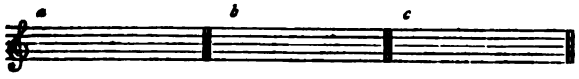
A quarter of an hour allowed for this paper.

1. What is meant by *sound*, what by a *tone*; and how does a sound differ from a tone?

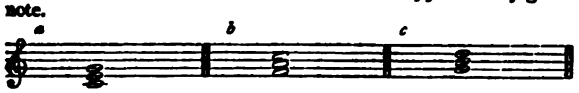
1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular, the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) *Do*, (F) *Fa*, and (G) *Sol*.



2. A *triad* is the addition of its *third* and *fifth* to any given note.



3. How many tones and how many semitones are found in the diatonic major scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. At what rate per cent. would £1,720 amount to £1,978 in five years?

Interest on £1,720 = £(1,978 − 1720) = £258.

5 yr. : 1 yr. } :: £258 : ?
£1720 : £100 }

$\frac{£258 \times 100}{5 \times 1720} = 3$ p. c. Ans.

2. What sum of money must be invested at $3\frac{3}{4}$ per cent. so as to secure an annual income of £250?

£3¾ : £250 :: £100 : ?

$\frac{£100 \times 250 \times 4}{15} = £6,666\ 13s.\ 4d.$ Ans.

3. Find the interest on £1,813 19s. at $3\frac{1}{2}$ per cent. for nine months.

£	s.	d.	
1813	19	0	
			3½
453	9	9	
5441	17	0	
5895	6	9	
			¾
4 | 17686	0	3	
44·21	10	0·75	
	20		
4·30 s.			
	12		
	3·675		

Interest = £44 4s. $3\frac{675}{1000}$d. Ans.

4. What is the difference between the annual income arising from the investment of £2150 in $3\frac{1}{2}$ per cent. stock at $87\frac{1}{8}$, and that from investing the same sum in the 3 per cents. at $86\frac{1}{4}$?

(*a*) Interest per £ in the $3\frac{1}{2} = \frac{3\frac{1}{2}}{87\frac{1}{8}} = \frac{26}{697} = \frac{1144}{30668}$

(*b*) „ „ 3 $= \frac{3}{86\frac{1}{4}} = \frac{6}{173} = \frac{1144}{30668}$

diff. of interest per £ invested $= \frac{312}{30668}$

∴ £2150 × $\frac{312}{30668}$ = £$\frac{670800}{30668}$ = £5 12s. $8\frac{30480}{30668}$d. Ans.

FEMALES.

1. Simplify $\frac{901}{713} \div \frac{1343}{1219} \times \frac{5353}{2449}$

$\frac{901 \times 1219 \times 2449}{713 \times 1343 \times 5353} = \frac{53}{101}$ Ans.

2. Find the value of $6\frac{7}{10}$ days − $\frac{2}{7}$ week − $\frac{11}{15}$ min. + $\frac{3}{5}$ hr.

		da.	ho.	min.	sec.
$6\frac{7}{10}$ days	=	6	16	48	0
− $\frac{2}{7}$ wk.	=	4	12	0	0
diff.	=	2	4	48	0
− $\frac{11}{15}$ min.	=				44
diff.	=	2	4	47	16
+ $\frac{3}{5}$ ho.	=			36	0
sum.	=	2	5	23	16 Ans.

3. The rateable value of a person's property is fixed at $\frac{3}{4}$ of its gross value, which is 2,000 guineas. What will be his net income after paying two poor rates of 8½d., and 1s. 1d. in the pound respectively, a highway rate of 4½d. in the pound, and an income tax of $2\frac{1}{2}\frac{5}{9}$ per cent. on his gross income?

(*a*) ¾ of 2000 guin. = £1260 the rateable value.
(*b*) Rate per £ = 8½d. + 1s. 1d. + 4½d. = 2s. 2d.
(*c*) £1,260 at 2s. 2d. = £136 10s. 0d.
(*d*) Income tax = $\frac{£2100 \times 45}{16 \times 100}$ = 59 1 3
Total to pay 195 11 3
(*e*) £2,100 − £195 11s. 3d. = £1904 8s. 9d. net income.

4. $\frac{1}{5}$ of a draper's stock was destroyed by fire, $\frac{1}{4}$ of the remainder was injured by water; he sold the uninjured goods at cost price, and the injured goods at $\frac{1}{4}$ cost price, and realized £225. What did he lose by the fire?

Remaining stock injured by water $= \frac{1}{4}$ of $\frac{1}{5} = \frac{1}{20}$
" uninjured " $= \frac{1}{5} - \frac{1}{20} = \frac{3}{20}$
Selling $\frac{1}{20}$ for half cost price = selling $\frac{1}{40}$ at cost price.
$\therefore \frac{3}{20} + \frac{1}{40}$ or $\frac{7}{40}$ is sold for £225.
Then $\frac{7}{40} : \frac{71}{40} :: £225 :$ sum lost by fire.

$$\frac{£225 \times 71}{9} = £1775.$$ Ans.

Grammar.

1. 'I made them *lay* their hands in *mine*, and swear
To reverence the king as if he *were*
Their conscience, and their *conscience* as their king;
To ride abroad *redressing* human wrongs,
To honour *their own word* as if their God's.'

(*a*) Analyse the first three lines of the above.
(*b*) Parse the words in italics.
(*c*) Point out the conjunctions, and show what is the use of each in the above passage.

(*a*)

Sentence.	Kind of Sent.	Subject.	Predicate.	Object and Completion.	Connective.
(1) I made them lay their hands in mine and swear to reverence the king and their conscience	Principal	I	made	(1) them (direct) (2) lay their hands in mine (indirect) (3) and swear to reverence the king (indirect) (4) (to reverence) their conscience (indirect)	—
(2) as if he were their conscience.	Subordinate adv. to (1) (manner)	he	were (incomplet:)	their conscience (completion of Predicate)	as if
(3) as (*if it were*) their king	Subordinate adv. to (1) (manner)	(*it*)	(*were*) (incomplete)	their king (completion of Predicate.)	as (if)

(*b*) *Lay*—irreg. trans. verb, *lay, laid, laid*, infin., pres., indef., gov. by *made*, after which "to" is suppressed.
mine—simple pers pron., referring to *I*, 1st pers. com., sing., poss., attrib. to *hands*.
were—irreg. subst. verb, *am, was, been*, subjunctive, past indef., 3rd pers. sing., agr. with *he*.
their—pronom. poss. adj., limiting *conscience*.
conscience—abstr. noun, neut. sing., after *were*.
conscience— " " " " obj., gov. by (*reverence*).
redressing—reg. trans. verb, part. pres. attrib. to *them*.
their own—pron. poss. adj., limiting *word*.
word—abstr. noun, neut. sing. obj., governed by *honour*.

(*c*) (1) *and*—co-ord. conj., connecting two c'auses of equal importance, viz., '*swear to reverence the king*,' with '*lay their hands in mine*.'
(2) *as if*—subord. conjunc., connecting the subord. clause, '*he were their conscience*,' with the principal sent. '*I made . . . the king*.'
(3) *and*—co-ord. conj., connecting '(*to reverence*) *their conscience*' with '*to reverence the king*.'
(4) *as* (*if*)—subord. conj., connecting '(*it were*) *their king*' with '*I made them* (etc.), *and swear to reverence their conscience*.'
(5) *as if*—subord. conj., connecting '(*it were*) *their God's* (*word*)' with '*I made them* (etc.) *swear to honour their own word*.'

2. Some conjunctions are derived from nouns, some from adjectives. Give examples of both kinds, showing what noun or adjective each is derived from.

Both is only the adjective *both* used with relation to two sentences joined by *and*.
Either is the distributive adjective pronoun which stands for *other*, used with relation to a whole sentence.
That was originally the demonstrative adjective pronoun, used as the representative of a sentence.
Because is merely the compound phrase *by cause*.
Unless is a compound of *on* and the comparative *less*.
While is derived from *the while* = *the time*.

Geography.

Answer Q. 2 *or* Q. 3; *not both*.

1. Give full notes of a lesson on 'The St. Lawrence and the chain of lakes connected with it.'

N.B.—*No introduction*. Make your lesson full and descriptive.

'The St. Lawrence and the Great Lakes.'

Apparatus—Map of North America, or a Sketch on the Black Board.

The St. Lawrence receives different names in different parts of its course. Rises under the name of *St. Louis*, a little to the west of L. Superior, and near the sources of the Red River and the Mississippi. (*Show these rivers.*) Between L. Superior and L. Huron the river is called *the St. Mary;* between Huron and Erie *the St. Clair*, and *Detroit;* and between Erie and Ontario *the Niagara* (Falls of Niagara occur here, precipitated over rocks 150 feet high—*description given*). After leaving Ontario the river is called the St. Lawrence, which flows in a north-easterly direction into the Gulf of St. Lawrence. In this part of its course it receives the *Ottawa, Richelieu, St. Francis, St. Maurice*, and *Saguenay*. The total length of the river is 2000 miles.

Lake Superior is the greatest body of fresh water on the globe —420 miles long and 160 broad, and lies 630 ft. above the level of the sea. It receives 200 rivers and streams, and discharges its water into L. Huron.

Lake Huron, 200 miles long, 160 broad, communicates with L. Superior and L. Michigan on the west, and by St. Clair and the Detroit with L. Erie on the east. Along its northern shore is a chain of richly-wooded islands, called the *Manitoulin* or *Sacred Isles*.

Lake Michigan lies in the United States, is 360 miles long, with an average breadth of 60 miles, and is navigable for ships of any burden. It communicates with the north-west extremity of L. Huron.

Lake Erie is 250 miles long, and its greatest breadth 80 miles. It discharges its waters into Lake Ontario by the Niagara. It is subject to violent storms, which, with rocks projecting many miles from the shore, render the navigation extremely dangerous. The Erie Canal borders its shore, and avoids the Falls of Niagara, and the Ohio Canal connects it with the Ohio and the Mississippi.

Lake Ontario, the most easterly of the great American lakes, is 180 miles long and 65 broad, and of great depth. It receives the waters of Lake Erie by the Niagara, and discharges them by the St. Lawrence. Steam vessels constantly ply between the British and American sides. The country along its shores is rich and well wooded.

2. Draw little sketch maps to show the position, etc., of Ceylon, Hong Kong, the Mauritius, Antigua, Vancouver's Island; and say briefly what you know about each of them.

Ceylon is an island in the Indian Ocean separated from India by the Gulf of Manaar and Palk Strait. The interior of the southern part is mountainous, *Adam's Peak* being the highest point westward. There is only one river of any importance, the *Mahavelli Ganga*. The soil is rich and the vegetation luxuriant. Plantations of cinnamon border the coast on the S. W. for a hundred miles. The elephants of Ceylon are famed for their size and sagacity. The chief towns are *Colombo* and *Kandy*. The two principal ports are *Point de Galle* and *Trincomalee*.

Hong Kong is a small island at the mouth of the Canton river, ceded by the Chinese to Britain in 1842. The population is about 140,000, and the capital is Victoria.

Mauritius is an island in the Indian Ocean E. of Madagascar. Its most important production is sugar. It was named in honour of Prince Maurice of the Netherlands; and it has belonged to Britain since 1810. Bourbon is the capital.

Antigua is one of the Leeward group of the British West India Islands. The chief products exported are sugar, molasses, and rum. The capital is *St. John*.

Vancouver's Island forms part of the province of British Columbia, and lies off the west coast of British N. America. Its surface is well wooded and diversified by mountain ranges and

extensive prairies. Coal is abundant, and Victoria the capital is an important coaling-station.

3. Draw a map of the coast-line from Cadiz to Naples, and insert the lines of latitude and longitude.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Describe the reign of Edward the Confessor, and explain the kingdom's loss of strength at that period.

Edward the Confessor had been brought up at the Norman court, and this was the occasion of great trouble to him. The great Earl Godwin having gained complete supremacy over the king, married him to his own daughter, and established himself and his sons in the chief earldoms of the country. In Edward's court were some Norman nobles, who seemed to divide the king's heart with Godwin and his sons; these therefore sought to make it a national quarrel; but some of the earl's Saxon enemies sided with the Normans, and thus began that discord which weakened the Saxon influence. Civil war arose through a riot at Dover, but a truce was made without bloodshed, and Godwin and his sons were banished. William of Normandy having come over to England, the Norman influence grew stronger after his visit. A change came, and Godwin and his sons were re-instated, and shortly after the earl died, leaving his possessions to his son Harold, who continued to weaken the strength of the kingdom by civil wars and ceaseless broils. He is even said to have slain Edward's nephew and heir with his own hand. Upon this (1066) the old King gave the succession to his cousin William of Normandy. Edward abolished the Dane-gelt, and introduced Norman law-customs into English courts, which have never left them. The laws of the Confessor were regarded by the Saxons as the bulwark of the little liberty that remained to them under the sway of the Normans.

2. Tell the names of the mother and the wife of Stephen. Under what arrangement did his successor take the throne?

Stephen was the son of Adela, daughter of William I., and his wife was Matilda, daughter of the Count of Boulogne and niece of David of Scotland. His successor was Henry Plantagenet. By the treaty of Winchester Stephen was allowed to keep possession of the throne during his life, and Henry was to be his successor.

3. Between William I. and Henry VII. which of our kings met with a violent death? Briefly narrate the circumstances of each case, with dates.

While *William II.* was hunting in the New Forest, he was shop either intentionally or accidentally by an arrow from the bow of Sir Richard Tyrrel (1100).

Edward II. was put to death in a fearful manner in Berkeley Castle (1327).

Richard II. is supposed to have been murdered by assassins in Pomfret Castle (1399).

Henry VI. is believed to have been murdered in the Tower (1471).

Edward V. was murdered in the Tower by order of his uncle Richard III. (1483).

Richard III. was slain at the Battle of Bosworth (1485).

Composition.

Write full notes of a lesson on *A Farm*.

INTRODUCTION.—We are going to take a walk into the country to a *farm*. What road shall we take? We may go through fields. At which season would the children prefer to go? (*description of road to the farm-house*).

THE FARM-HOUSE.—Dwelling-house by itself—garden behind—with what vegetables?—orchard perhaps, kinds of *fruit-trees* in it—beehives perhaps, ask about bees.

OUTHOUSES.—The barn, granary, stable, cow-house, pig-sty, poultry-house, questions to draw out information respecting these houses and their uses. The barn may have a mill-wheel outside for turning machinery inside to thresh the corn, the winnowing machine to clean the grain before it is stored in the granary; in the stable may be horses, or they may be out ploughing, or taking grain to the mill to be ground into meal, etc.; in the cow-house may be cows to be milked (when?), or it may be clean and ready for them when they come from the fields in the evening. (*In the same way question the children about the other outhouses.*

ANIMALS.—The *horses* may be in the stables, or out in the fields, according to the season, drawing the plough, pulling the harrows, or the roller, the reaping machine, or pulling waggon-loads of hay, corn, etc., home to the farm; the *cattle* may be out feeding on the grass; the cows may be coming home to get milked; some may be in the stall fattening for the market; the *sheep* in the fields nibbling the grass in summer, or feeding on turnips during winter and early spring (*why?*); the poultry running about the farm-yard picking up grain, or the farmer's wife may be feeding them by scattering corn; dogs for watching house and herding sheep. (*Draw from them information about feeding the various animals.*)

IMPLEMENTS.—Ploughs, harrows, rakes, rollers, sickles, hoes, carts, waggons, reaping machines, etc.

FIELDS—for wheat, barley, oats, potatoes, turnips, pasture, hay, etc.

Pictures of the various objects to be shown if necessary.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used]

1. The angles which one straight line makes with another upon one side of it are either two right angles, or are together equal to two right angles.

Prop. 13, Bk. I.

2. The greater angle of every triangle is subtended by the greater side, or has the greater side opposite to it.

Prop. 19, Bk. I.

3. If from the ends of a side of a triangle there be drawn two straight lines to a point within the triangle; these shall be less than the other two sides of the triangle, but shall contain a greater angle.

Prop. 21, Bk. I.

Needlework.

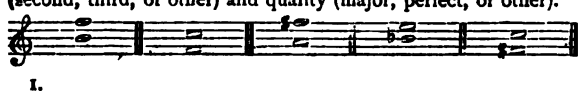
FEMALES.

One hour allowed for this exercise.

Music.

A quarter of an hour allowed for this Paper.

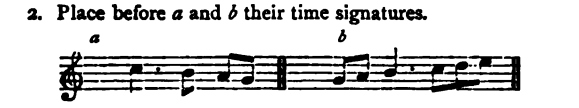
1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).



1.

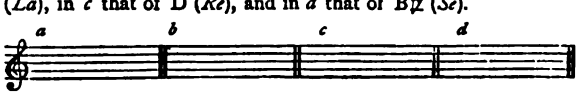
Imperf. 5th. Perfect 5th. Major 6th. Pluperf. 4th. Imperf. 5th.

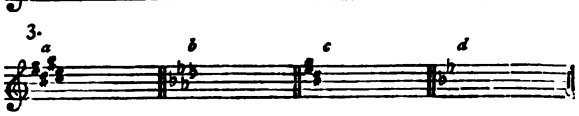
2. Place before *a* and *b* their time signatures.



2.

3. Write in *a* the scale signature of E (*Mi*), in *b* that of A♭ (*La*), in *c* that of D (*Re*), and in *d* that of B♭ (*Se*).



3.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. Air is composed of three gases, 75·55 per cent. being nitrogen, 23·32 oxygen, and 1·13 carbonic acid. In a chamber containing 3,274 cubic feet, how much is there of each gas?

Nitrogen = $\frac{75\cdot55}{100}$ of 3,274 c. ft. = 2473·507 cub. ft. Ans.

Oxygen = $\frac{23\cdot32}{100}$ „ = 763·4968 „ Ans.

Carbonic acid = $\frac{1\cdot13}{100}$ „ = 36·9962 „ Ans.

2. If 1 cwt. 3 qrs. 4 lbs. are purchased for £50, what should be the retail price per lb. to give a profit of 5 per cent.?

1 cwt. 3 qrs. 4 lbs. = 200 lbs.
∴ £50 ÷ 200 = 5s. the price of a lb.
100 : 105 :: 5s. : retail price.
$\frac{5s. \times 105}{100}$ = 5s. 3d. Ans.

3. How many planks, each 13½ feet long and 10½ inches wide, will be required for the construction of a platform 54 yds. long and 21 yds. broad? What will be the cost at 5½d. per sq. foot?

(*a*) Area of platform = 54 yds. × 21 yds. = (1134) sq. yds.
„ „ planks = 13½ ft. × 10½ in. = (162 × 10½) sq. in.
∴ The No. of planks = $\frac{1134 \times 9 \times 144 \times 2}{162 \times 21}$ = 864 Ans.

(*b*) 1134 sq. yds. at 5½d. per sq. ft. =
10206 sq. ft. at 5½d. each = £233 17s. 9d. Ans.

4. Explain the difference between simple and compound interest, and compare the interest of £119 for 3 years at 4 p. c. on the two methods.

Simple interest is when the interest is always kept distinct from the principal. Compound interest is when the interest is added at certain periods to the principal, and interest allowed on the increased amount.

(*a*) Simple interest on £119 for three years at 4 p. c. =
£ $\frac{119 \times 3 \times 4}{100}$ = £14·28 = £14 5s. 7·2d.

(*b*) Compound interest—

4 p. c. gives $\frac{1}{25}$ of principal to be added every year.

£	
119	
4·76	
123·76	Amt. for 1st year
4·9504	
128·7104	„ „ 2nd „
5·148416	
133·858816	„ „ 3rd „
119	
14·858816	Comp. int. at end of 3rd yr.

= £14 17s. 2·1d.

FEMALES.

1. What is the quotient of 129·75896 divided by 8, by ·08, by ·0008, and by 800 respectively?

(*a*) 8 | 129·75896 = 16·21987 Ans.

(*b*) ·08 | 129·75896 = 1621·987 Ans.

(*c*) ·0008 | 129·75896 = 162198·7 Ans.

(*d*) 800 | 129·75896 = ·1621987 Ans.

2 Compare the values of ·875 of 10s. 6d. and ·785 of 13s. 4d.

(*a*) ·875 of 10s. 6d. = 9s. 2½d. Ans.
(*b*) ·785 of 13s. 4d. = 10s. 5$\frac{5}{7}$d. Ans.
(*b*) is greater than (*a*) by 1s. 3$\frac{2}{7}$d.

3. Find the values of (*a*) ·890625 bus.
(*b*) £2·3375.
And explain the method in each case.

(*a*)

	·890625 bus.
Multiply by 4 to reduce to pks.	4
Cut off 6 decimals	3·562500 pks.
Multiply fractional part by 2 to reduce to galls.	2
Point off 6 decimals	1·125000 gall.
Multiply the fractional part by 8 to reduce to pts.	8
Point off 6 decimals	1·000000 pt.

3 pecks. 1 gall. 1 pt. Ans.

(*b*)

	£2·3375
(1) Multiply the fractional part by 20	20
and point off 4 decimals to get	6·7500s.
(2) Multiply the fractional part by 12	12
and point off 4 decimals to get	9·0000d.

£2 6s. 9d. Ans.

4. A.'s farm contains 100·46875 acres, which lacks ·28125 acres of being ¼ as large as B.'s; B.'s farm exceeds 6 times C.'s farm by 5·725 acres. Find the extent of the 3 farms.

	acres.	ac.	ro.	po.
A.'s farm =	100·46875	= 100	1	35
B.'s „ =	(100·46875 + ·28125) × 4	= 403	0	0
C.'s „ =	(403ac. − 5ac. 2ro. 36po.) ÷ 6 =	66	0	34
∴ The extent of the three farms =		569	2	29 Ans.

Grammar.

1. 'Oh, but they say, the words of dying men
Enforce attention like deep harmony.
Where words are scarce, they are seldom spent in vain;
For they breathe truth that breathe their words in pain;
He that no more must say is listened more
Than they whom youth and ease have taught to gloss.
More are men's ends marked than their lives before.'
SHAKESPEARE.

(*a*) Point out the adjective sentences in the above. Show why adjective sentences are so called, and how they are generally joined to the principal sentence.

(*b*) Parse all the participles and infinitive moods that occur in the above.

(*c*) Give the meaning of the above passage in your own words.

(*a*) The adjective sentences are:—
(1) 'that breathe their words in pain.'
(2) 'that no more must say.'
(3) 'whom youth and ease have taught to gloss.'

Adjective sentences are so called because they are joined to some noun or pronoun in the principal sentence, to which noun or pronoun they are attributive, thus No. (1) is attributive to 'they,' No. (2) to 'he,' and No. (3) to 'they.' The connective word is generally a relative pronoun expressed or understood.

(*b*) *dying*—reg. intrans. verb, incomplete part. qual. *men*.
spent—irreg. trans. verb, *spend, spent, spent*, complete part. attrib. to 'they,' and forming pass. voice with 'are.'
say—irreg. trans. verb, *say, said, said*, infin. pres. indef., gov. by must.
listened (to)—reg. trans. verb (now only used transitively with 'to,' complete part. attributive to 'he.'
taught—irreg. trans. verb, *teach, taught, taught*, complete part. forming the pres. perfect tense with 'have.'
to gloss—reg. intrans. verb, infin. pres. indef., gov. by 'taught.'
marked—reg. trans. verb, complete part. attributive to 'ends.'

(*c*) It has been said that very great heed is paid to men's dying utterances, similar to the influence which grand music exercises over men's minds. Men, who say little, generally speak to the purpose, for those who are in trouble speak truly, and he that speaks for the last time is reverenced much more than he who, from various circumstances, has acquired a certain glibness of speech. The end of a man's life comes out more distinctly than any other period of his existence.

2. Give examples to show how the infinitive mood may form (*a*) the subject, (*b*) the object of a sentence.

Subject.	Object.
(1) *To walk* in the fields is pleasant.	(1) He ordered him *to stand* aside.
(2) *To err* is human.	(2) Youth and ease have taught them *to gloss*.
(3) *To laugh* is better than *to cry*.	(3) I saw the bird *fly*.

3. Give three words compounded with each of the following Latin prepositions:—*ob*, *præ* (pre), *trans* (tres).

Words compounded with *ob*—*ob*stacle, *oc*cur, *opp*ose.
" " " *præ*—*pre*dict, *pre*cede, *pre*position.
" " " *trans*—*trans*late, *tres*pass, *tra*duce.

Geography.

Answer *two* questions.

1. Five full notes of a lesson on the St. Lawrence, and the chain of lakes connected with it.

Illustrate by a map, and insert the lines of latitude and longitude.

See under 2nd year.

2. What is a water-parting? Illustrate your answer by reference to the mountain chains of Asia, and the rivers which flow from them in different directions.

A *water-parting* is the spot or line at which the surface-water of a mountain, hill, or swelling-ground parts, and begins to flow down the slope on each side.

The principal water-parting of Asia traverses its central regions in a general north-easterly direction, and sends the rivers in five different directions, corresponding to the five great basins to which they respectively belong. Beginning at the central group of the Hindu Kush, where the rivers rise that flow to the Indian Ocean, *e.g.*, the Indus and the Brahmaputra, we may trace the water-parting along the Thian-shan, the Altai, the Yablonoi, and the Stanovoi Mts., N.E. to Behring's St., which throws on the one side the Irtish, Yenesei, and Lena, into the Arctic Ocean, and on the other the Yang-tse Kiang, the Hoangho, and the Amur, into the Pacific. Again the water-parting may be traced westerly to Asia Minor, along the Taurus Mts. by watching the flow of the Euphrates, Tigris, and others southwards, and the Kizil Irmak and others into the Black Sea.

3. Describe fully the course of the River Nile.

The Nile is formed by the union of two streams; the main branch, called Bahr el Abiad, or the White Nile, has its origin in an elevated region of lakes and countless streams, practically in the Victoria N'yanza and Albert N'yanza. Uniting at Khartoum, in Nubia, with the Bahr el Azrek, or Blue River, from Abyssinia, it forms one large stream which flows through Nubia and Egypt, where it is confined between mountain ranges. Near Cairo the valley widens, and the Nile, separating into two great arms, enters the broad plain of the Delta, which it encloses, and falls into the Mediterranean by the western mouth at Rosetta, and by the eastern at Damietta. The length of its course is supposed to be about 3,000 miles. From the junction of the Tacazze or Atbara, 1,740 miles from its mouth, the Nile receives no tributary. Its delta is flat, 90 miles long, and 180 miles of coast. The annual inundations of the river bring down chiefly from the Blue Nile the immense diluvium which fertilizes Egypt.

SECOND PAPER.

Two hours and a half allowed.

History.

1. During the reign of Henry VIII., what changes were made in the Government of Wales and Ireland?

In the reign of Henry VIII., Wales became really united with England (1536). The remains of feudal power held by the barons were aboli-hed, English laws were established, and Welsh members were elected to the House of Commons.

Hitherto Ireland had been styled a lordship of the English crown, but Henry raised it to the rank of a kingdom. From the time of Strongbow, Ireland had never been so thoroughly in a conqueror's grasp than in Henry's time. The power of the crown was acknowledged over the length and breadth of the land. But submission was not all that Henry desired; his aim was to civilize the people, not by force, but by law. But the only law which he or his ministers could frame was that of the English law, which they forced upon Ireland both in civil and religious matters. This action led to those national troubles that have lasted even to the present time.

2. Briefly narrate events which make the following dates remarkable in our history:—1658, 1666, 1679, 1685, and 1715.

Cromwell, worn out by incessant care, died of ague in 1658.

In 1666, the Great Fire of London broke out, and rendered two hundred thousand people homeless. Though the fire caused the loss of St. Paul's Cathedral, yet it burnt out the infection of the plague.

1679 will ever be memorable in our history as the year in which was passed the famous measure called the *Habeas Corpus Act*. This statute secures the personal freedom of all English subjects that obey the law.

1685 is memorable for the unfortunate insurrections of Argyle in Scotland, and Monmouth in England. The Battle of Sedgemoor was followed by the wholesale hanging of the rebels by Judge Jeffreys, in the Bloody Assize.

In 1715, the Earl of Mar raised a rebellion in Scotland in favour of the Pretender, but he was completely routed at Sheriffmuir.

3. In what reigns did the following persons live:—Simnel, Geo. Villiers (Duke of Buckingham), Marlborough, Clive, and Admiral Byng? Tell the history of one of them.

Simnel lived in the reign of Henry VII.; *George Villiers*, in the reigns of James I. and Charles I.; *Marlborough* in the reigns of William III. and Anne; *Clive* and *Admiral Byng* in the reign of George II.

Lambert Simnel, trained to personate Edward, Earl of Warwick, succeeded in his imposture in Ireland, but having tried his fortune in England, he was defeated and captured at Stoke, near Newark, in 1487. He was made a scullion in the royal kitchen.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, but the base of one greater than the base of the other; the angle contained by the sides of the one which has the greater base shall be greater than the angle contained by the sides equal to them of the other.

Euclid, I., 24.

2. If a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles; and the three interior angles of every triangle are together equal to two right angles.

Euclid, I., 2.

3. Equal triangles upon the same base and upon the same side of it are between the same parallels.

Euclid, I., 39.

Algebra.

MALES.

1. Add together $1-(1-\overline{1-x})$, $2x-(3-5x)$, and $2-(-4+5x)$.

$$\begin{aligned} 1-(1-\overline{1-x}) &= 1-1+1-x = 1-x \\ 2x-(3-5x) &= 2x-3+5x = -3+7x \\ 2-(-4+5x) &= 2+4-5x = 6-5x \\ & \qquad\qquad\qquad\qquad 4+x. \text{ Ans.} \end{aligned}$$

2. Find the G. C. M. of—

$48x^2+16x-15$ and $24x^3y^3-22x^2y^2+17xy^2-5y^3$.

Casting out y^2 from the second expression, we have

$$\begin{array}{r} 24x^3-22x^2+17x-5 \\ \hline 48x^2+16x-15\,)\,48x^3-44x^2+34x-10\,(x \\ 48x^3+16x^2-15x \\ \hline -60x^2+49x-10 \\ -4 \\ \hline)\,240x^3-196x+40\,(5 \\ 240x^3+80x-75 \\ \hline -23 \mid -276x+115 \\ 12x-5 \end{array}$$

Now $48x^2+16x-15=(12x-5)(4x+3)$

$\therefore$ $12x-5$ is the G. C. M. Ans.

3. Solve the equations:—

(1) $\frac{4x}{5}-\frac{5x}{4}=-18+\frac{1}{5}(4x+1)$

(2) $\frac{10x+17}{18}-\frac{12x+2}{11x-8}=\frac{5x-4}{9}$

(1) $\frac{4x}{5}-\frac{5x}{4}=-18+\frac{1}{5}(4x+1)$

$\frac{16x-25x}{20}=\frac{-162+4x+1}{9}$

$-81x=-3220+80x$

$161x=3220$

$x=20.$ Ans.

(2) $\frac{10x+17}{18}-\frac{12x+2}{11x-8}=\frac{5x-4}{9}$

$\frac{10x+17-10x+8}{18}=\frac{12x+2}{11x-8}$

$\frac{35}{18}=\frac{12x+2}{11x-8}$

$275x-200=216x-36$

$59x=236$

$x=4.$ Ans.

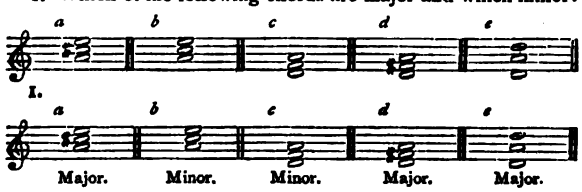
Needlework.

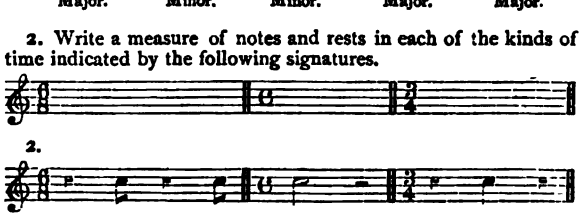
FEMALES.

One hour allowed for this Exercise.

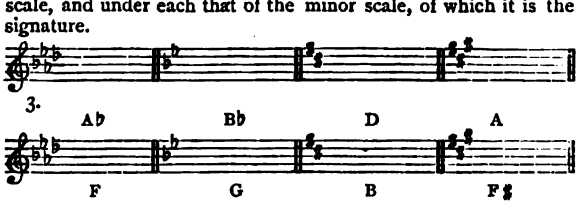
Music.

A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* 1st *May,* 1878; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What fraction is a foot and a half of a quarter of a mile? Express the answer as a vulgar fraction, and also decimally.

$1\frac{1}{2}$ ft. to the fraction of 1320 ft. $=\frac{1\frac{1}{2}}{1320}$

$=\frac{\frac{3}{2}}{\frac{2640}{2}}$

$=\frac{3}{2640}$ or $\cdot 001136$. Ans.

2. Simplify the expression—

$$\frac{\frac{3}{5}\text{ of }1\frac{2}{3}\text{ of }2\frac{1}{2}}{\frac{7}{6}+1\frac{5}{12}-\frac{3}{4}}$$

$$(\tfrac{3}{5}\text{ of }1\tfrac{2}{3}\text{ of }2\tfrac{1}{2})\div(\tfrac{7}{6}+1\tfrac{5}{12}-\tfrac{3}{4})=$$

$$\left(\frac{2\times5\times12}{9\times3\times5}\right)\times\left(\frac{36}{28+15-27}\right)=$$

$$\frac{2\times5\times12\times36}{9\times3\times5\times16}=2.$$ Ans.

3. Multiply ·0204 by 40·2; divide ·04 by 20, ·4 by ·002, ·0004 by ·0002, and 400 by ·02. Prove the truth of four results by means of vulgar fractions.

(*a*)

·0204
40·2
408
8160
·82008

$\frac{204}{10{,}000}\times\frac{402}{10}=\frac{82.008}{100{,}000}=\cdot 82008.$ Ans.

(*b*) $\cdot\frac{04}{20}=\frac{4}{1000}\div\frac{20}{1}=\frac{4\times1}{2\times1000}=\frac{2}{1000}=\cdot 002.$ Ans.

(*c*) $\cdot\frac{4}{0002}=\frac{4}{10}\div\frac{2}{10000}=\frac{4}{2}\times\frac{10000}{10}=200.$ Ans.

(*d*) $\frac{\cdot 0004}{\cdot 0002}=\frac{4}{10{,}000}\div\frac{2}{10{,}000}=\frac{4}{2}\times\frac{10{,}000}{10{,}000}=2.$ Ans.

(*e*) $\cdot\frac{400}{02}=\frac{400}{1}\div\frac{2}{100}=\frac{400}{2}\times\frac{100}{1}=20{,}000.$ Ans.

4. If the 3 per cent. consols be at $90\frac{3}{4}$, what sum must I invest in order to secure from them a yearly income of £470 after paying an income tax of 5d. in the pound; brokerage being at $\frac{1}{4}$ per cent.?

$$\left.\begin{array}{l} £3 : £470 \\ 235\text{d.} : 240\text{d.} \end{array}\right\} :: £90\tfrac{3}{4} : ?$$

$$£\tfrac{363}{4}\times\frac{470\times240}{3\times235}=121\times2\times60=£14{,}520.$$ Ans.

FEMALES.

1. At what rate per cent. will £7864 12s. 6d. amount in 5 years to £9175 7s. 11d.?

Interest $=$ £9175 7s. 11d. $-$ £7864 12s. 6d. $=$ £1310 15s. 5d.

$$\left.\begin{array}{l} 5\text{ yrs.} : 1\text{ yr.} \\ 7864\tfrac{1}{8} : 100 \end{array}\right\} :: £1310\ 15\text{s. } 5\text{d.} : ?$$

$$£\tfrac{1311543}{200}\times\frac{1\times100\times8}{5\times62917}=£3\tfrac{1}{2}\text{ per cent.}$$

2. Find the present worth of £259 7s. due 4 years hence at $3\frac{1}{2}$ per cent. simple interest.

Simple interest of £100 for 4 years at $3\frac{1}{2}$ p. c. $=$ £14

Amount " " " $=$ £114

$\therefore$ £114 : £100 :: £259 7s. : present worth.

$$\frac{£259\ 7\text{s.}\times100}{114}=£227\ 10\text{s.}$$

3. A man bought a cask of sugar containing $2\frac{1}{2}$ cwt. at $4\frac{1}{2}$d. a lb.; allowing $2\frac{1}{2}$ per cent. for waste, what must he sell it at per lb. in order to gain not less than 25 per cent.?

(*a*) $\frac{97\frac{1}{2}}{100}$ of 280 lbs. $=273$ lbs.

(*b*) 273 are to be sold for $\frac{5}{4}$ of the price of 280 at $4\frac{1}{2}$d.

i.e. " " 1575d.

$\therefore$ the selling price of 1 lb. $=\frac{1575}{273}$d. $=5\frac{10}{13}$d.

And to gain not less than 25 p. c. the sugar must be sold for 6d. per lb.

4. A, B, and C commence business; A brought £175, B £210, they gained £422 10s., of which C's share was £172 5s. What amount did C put into the business?

(*a*) (£175+£210) gets (£422 10s. − £172 5s.)
or £385 gets £250 5s.

(*b*) ∴ £250 5s. : £172 5s. :: £385 : C's share.

$$\frac{£385 \times 3445}{5005} = £\frac{2652}{10} = £265. \quad \text{Ans.}$$

Grammar.

1. 'We cannot be guilty of a greater act of uncharitableness than to interpret the afflictions which befall our neighbours *as punishments and judgments*. It aggravates the evil to him who suffers, when he looks upon himself as the mark of Divine vengeance, and *abates* the compassion *of those towards him*, who regard him in *so dreadful a light*.' ADDISON.

(*a*) Analyse the above from '*We cannot*' to '*judgments*.'

(*b*) Parse the words in italics.

(*c*) Write out the sense of the above in simple words of your own.

(*a*) (1) 'We cannot be guilty of a greater act of uncharitableness than to interpret the afflictions as punishments and judgments'—(*Principal clause*).

(2) 'Which befall our neighbours'—(*Subordinate adjective clause to* '*afflictions*').

(1) (*a*) We...*subject.*
(*b*) cannot be...*incomplete predicate.*
(*c*) guilty of a greater act of uncharitableness...*adj. phrase completing predicate.*
(*d*) than to interpret the afflictions.. *adv. phrase of comparison extending predicate*
(*e*) as punishments and judgments...*adv. phrase extending predicate and modifying* (*d*).

(2) (*a*) Which...*subject.*
(*b*) befall...*predicate.*
(*c*) neighbours...*simple object.*
(*d*) our...*enlargt. of* (*c*).

(*b*) *As*—subordinative adv. conj. mod. 'interpret' and connecting the phrase 'punishments and judgments' with 'afflictions.'
punishments—abstr. noun, neut., plur., obj. gov. by 'interpret.'
and—co-ord. conj. connect 'judgments' with 'punishments.'
judgments—abstr. noun, neut., plur., obj. gov. by 'interpret.'
abates—reg. trans. verb, indic., pres. indef., 3rd pers. sing. agr. with 'it.'
of—prep. gov. obj. case 'those' which it relates to 'compassion.'
those—demonstr. pron., 3rd pers. com. plur., obj., gov. by 'of.'
towards—prep. gov. obj. case 'him,' which it relates to 'compassion.'
him—pers. pron. 3rd pers. sing, mas. obj., gov. by 'towards.'
so—adv. of deg., mod. 'dreadful.'
dreadful—adj. qual. 'light.'
a—indef. art. or adj. limiting 'light.'
light—abstr. noun, neut. sing. obj. gov. by 'in.'

(*c*) It is unkind as well as unjust to consider men's misfortunes to be a sign of God's displeasure with their conduct. Such thoughts destroy our sympathies with our fellow-creatures, and when the unfortunate themselves look upon their misfortunes in the same light, their miseries are increased tenfold.

2. Point out traces of the Scandinavian element in our language, and state whether it is most nearly allied to the Saxon or to the Latin.

In consequence of the incursions of men of Scandinavian race (who were of the Teutonic stock), many Scandinavian words made their way into common use, and these appear in many names of places in the districts occupied by the Scandinavian invaders, such as *by*, meaning a 'town,' as Grimsby, Whitby, Ho'mby; *Scaw*, a 'wood,' as Scawfell; *force*, a 'waterfall,' as Stockgill Force; *ness*, 'headland,' as in Furness; *ey*, an 'island,' as Bardsey.

Most of the Teutonic elements came in with the Saxons and Angles, but a good many came in with the Danes and Norsemen, that is with the Scandinavians, and of course their language must be more closely allied to the Saxon than to the Latin.

3. Write notes of a lesson on 'Case.'

CASE.—From Lat. *casus*, a falling—an inflection of nouns and pronouns to show the relation which they bear to other words. (Show from examples on black-board how easy it is to know the cases of pronouns, like, *I, mine, me, he, his, him*, even without seeing them in a sentence; but that it is impossible to tell the cases of nouns unless we see them in a sentence. Possessive case, however, easily known; *e.g. John's* hat, *Mary's* bonnet, *Tom's* kite.)

POSSESSIVE CASE.—Formerly formed by adding *es*—thus *boy, boyës;* hound, houndës, etc.—afterwards *e* left out and (') apostrophe put in to mark the omission—(*compare e'er and e'en*)—possessive singular takes 's—possessive of plurals ending in *s* take (') only (*examples to be given*). Living beings only, as a rule, take the sign of the possessive—thus, not *the desk's top*, but *the top of the desk.*

NOMINATIVE and OBJECTIVE CASES.—Not known by the look of them when belonging to nouns—*I have a book; A book lies here.* 'Book' has the same look in each sentence, but in the former it is the *object* of *have*, or in *objective* case, and in the second it is the subject of *lies*, or in the *nominative* case (a more appropriate name would be the *subjective* case); transitive verbs take an object after them—nominative found by asking the question Who? or What? with the verb; thus, 'I saw the boy.' *Who* saw the boy? *I, i.e.* the subject—objective case found thus: 'I saw whom'? or 'I saw what'? Ans. *the boy;* therefore *boy* is the object or objective case governed by 'saw.' Objective case follows prepositions, as 'to him,' 'from me,' 'with John.' (*Exercises to be given from reading-books; examples dictated by scholars to be written by teacher on black-board.*

Geography.

1. What is a water-parting? Illustrate your answer by reference to the mountain chains of Asia and America, and the rivers which flow from them.

A 'water-parting' is the spot or line at which the surface-water of a mountain, hill, or swelling ground parts, and begins to flow down the slope on each side. Thus the Hindu Kush Mts. form the water-parting between the basins of the Indus and the Amoo, the Himalaya separating the basin of the Ganges from the upper basin of the Brahmaputra, the north-eastern system of Asiatic Mts. separating the river-basins that incline to the Arctic Ocean from those inclining to the Pacific, and embracing (1) the *Thian-Shan*, separating the basins of the Obi and the Yarkand; (2) the *Altai* and *Yablonoi* Mts., separating the basin of the Amoor from those of the Yenesei and Lena; (3), the Stanovoi and Aldan Mts.

In America the Mts. in the northern half of the continent arrange themselves in two grand divisions—an eastern and a western—which are separated from each other by the great central plain; (1), the Alleghanies extend from the Gulf of St. Lawrence to the State of Alabama, and form the water-parting between the basins of rivers flowing eastward into the Atlantic from the two great basins of the Mississippi and the St. Lawrence; (2), the Rocky Mts. extend from the Arctic Ocean to Lake Nicaragua in Central America. The two principal ranges are—1. the Pacific Range, extending along the Western Coast from Alaska to the peninsula of California, and forming the water-parting between the Pacific Ocean on the west, and the Youcon and Rio Colorado on the east. 2. The Rocky Mountain Chain forms a wavy line from the Mackenzie in the Arctic Ocean to near Lake Nicaragua, and separates the basins of the Colville, Youcon, Frazer, Columbia, and Rio Colorado on the west from those of the Mackenzie, Saskatchewan, Missouri, Arkansas, and Rio del Norte on the east.

In South America the Andes, which traverse this continent in its greatest length, form the water-parting which separates the insignificant streams of the Pacific basin from the vast basins of the Amazon and others, comprising the most gigantic rivers on the earth's surface.

2. Draw a full map of the Indian Ocean, and insert the lines of latitude and longitude.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What benefits did this country derive from the Roman Occupation?

When Julius Cæsar came to Britain the inland parts of the country were thinly peopled by a race of warriors who lived by hunting and by herding cattle, and dwelt in huts of wood or wickerwork; their clothes were made of skins; their bodies stained blue. In the south the people were, from intercourse with Gaul, more civilized. Under the Romans their commerce, which was before inconsiderable, improved immensely, and much progress was made in manufactures of bronze and pottery. Although the Romans had been the cause of much bloodshed, yet they did much to improve the condition of the Britons. They taught them how to dress and arm themselves; they had made great military roads; they had built forts; and they had refined the whole British way of living. Above all, it was in the Roman time, and by means of Roman ships, that the Christian religion was first brought into Britain.

2. What events led to the Norman Conquest?

It is said that Edward the Confessor had promised to make William, Duke of Normandy, his successor; and that Harold, who usurped the crown on the death of Edward, had, when he was shipwrecked on the coast of Normandy, sworn to give William his support. Hearing of Harold's election to the vacant throne, William, burning with rage, collected a mighty host, built a great fleet, and made all Europe believe that he was the rightful heir. He prevailed on the Pope to excommunicate Harold, and to send a consecrated banner for his army. Having met Harold's army at Senlac, near Hastings, he totally defeated it, and Harold being killed, William was crowned king on Christmas Day, 1066.

3. In what respects do you consider the people of this country to be better or worse off under Victoria than their forefathers were under Edward I.?

The poorest working man is better off in obtaining the necessaries and even the luxuries of life than the nobles of the reign of Edward. The holding of Parliament, as we now have it, was only beginning, and Edward was accustomed to levy taxes, force loans, which he seldom paid, and demand purveyance. This purveyance shows very strongly the better condition of the people now. Where the king travelled the right of purveyance gave him liberty to force husbandmen to work, or lend their horses for the service of the royal household; and it was customary for farmers to hide their geese and chickens from the rapacity of the king's servants. Now English and Scotch are one; under Edward they were stern foes. The people at the present time are better off for houses, fuel, lighting, clothing, learning (only the very richest, and those who had leisure like the clergy, could read or write), just laws, freedom of religious opinions and worship, sanitary laws, security of person and property, communication between places—in fine, for all the conveniences of life. With a change of time and place, we may say with Tennyson—

'Better fifty years of Europe than a cycle of Cathay.'

Six hundred years must have made vast changes for the better in the civilization of England, though we must confess to an appalling want of civilization in some of the Irish subjects of Her Majesty.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write a short essay on *The Electric Telegraph and its uses.*

After many untiring experiments and patient investigation, the efforts of scientific men were crowned with success in mastering one of the secrets of nature. It was found that the electricity which works such havoc in thunder-storms could convey messages with the speed of thought over continents and under oceans, communicating instantaneously the information which men wished to convey to each other.

The first line of telegraph was made on the Blackwall Railway, and used at first for the sending of railway signals. After a little the telegraph printed the messages sent, and the telegraphs at first constructed for the use of the railway companies became, by the transmission of public business, a very profitable enterprise.

The use of this wonderful invention spread with amazing rapidity, and soon nations across the sea acquired lines of their own. Dublin was connected with London; Dover with Calais; and in a short time the idea of constructing a submarine telegraph to America became an accomplished fact.

Soon all civilized countries were connected; and poor and insignificant must the nation be that does not now possess a well-employed telegraph system.

In England the State purchased all telegraphs in 1868, and so extended them that every village in the kingdom soon enjoyed the privilege of almost instantaneous communication with every part of the world.

The telegraph has been well characterized as the first human invention which was obviously final. Steam may give way to some yet mightier power; gas is being superseded by a better method of lighting, but no agency can ever excel that which is instantaneous. Here, for the first time, the human mind has reached the utmost limit of its progress.

The union of distant localities by telegraph has quickened the interest which men have in the concerns of each other, and has roused an ever-increasing eagerness for news. The use of the telegraph for informing the Government of what is transpiring at home, in the Colonies, or in foreign countries, cannot be overestimated. The merchant uses it in every branch of his business; in short, it would be difficult to mention where the telegraph is not useful for speedy conveyance of every kind of intelligence.

The telephone has added still more to the power of this wonder of our age.

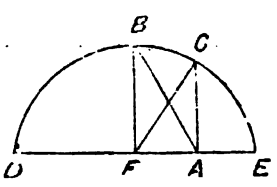
Euclid.

MALES.

Answer two Questions, including (if possible) Q. 1.

[All generally understood abbreviations for *words* may be used.]

1. From any point in the diameter of a semicircle two lines are drawn to the circumference, one to the middle point of the arc, the other at right angles to the diameter. The squares on these lines are together double the square on the radius.



From the point A in the diameter DE of the semicircle DBC, let the two lines AB, AC be drawn, namely AB to B (the middle point of the arc ABC,) and AC at right angles to DE. Then the squares on AB, AC, shall be together double of the square on the radius, *i.e.*, on FB.

Since B is the middle point of the arc DBE, FB is evidently at right angles to DE; therefore

the sq. on BA = sq. on BF + sq. on AF

but the sq. on CA = sq. on FC − sq. on AF

by add. ∴ the sq. on BA + sq. on CA = sq. on BF + sq. on FC

that is, the sqs. on BA and CA = twice the sq. BF (the radius).

Q. E. D.

2. If a straight line be divided into any two parts, the rectangle contained by the whole and one of the parts is equal to the rectangle contained by the two parts, together with the square on the aforesaid part.

(Prop. 3, Book II.)

3. In every triangle, the square on the side subtending either of the acute angles is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides and the straight line intercepted between the acute angle and the perpendicular let fall upon it from the opposite angle.

(Prop. 13, Book II.)

Algebra.

MALES.

1. Divide $x^3-apx^2+a^2px-a^3$ by $x-a$.

$$x-a)x^3-a^3-apx^2+a^2px(x^2+ax+a^2-apx. \quad \text{Ans.}$$
$$x^3-ax^2$$
$$ax^2$$
$$ax^2-a^2x$$
$$a^2x-a^3$$
$$a^2x-a^3$$
$$-apx^2+a^2px$$
$$-apx^2+a^2px$$

2. Reduce to lowest terms

$$\frac{x^2+(a+c)x+ac}{x^2+(b+c)x+bc} \text{ and } \frac{4x^2-12ax+9a^2}{8x^3-27a^3}.$$
$$\frac{x^2+(a+c)x+ac}{x^2+(b+c)x+bc}=\frac{x^2+ac+cx+ac}{x^2+bx+cx+bc}$$
$$=\frac{(x+c)(x+a)}{(x+c)(x+b)}$$
$$=\frac{x+a}{x+b} \quad \text{Ans.}$$
$$\frac{4x^2-12ax+9a^2}{8x^3-27a^3}=\frac{(2x-3a)(2x-3a)}{(2x-3a)(4x^2+6ax+9a^2)}$$
$$=\frac{2x-3}{4x^2+6ax+9a^2}$$

3. Solve the equations—

$$\text{(1.)} \quad \begin{cases} x+y=38\frac{1}{2}-\frac{4x+12y}{10} \\ 22y+21x=452 \end{cases}$$
$$\text{(2.)} \quad \frac{1}{x-1}-\frac{1}{x+3}=\frac{1}{35}$$

(1.) (a) $x+y=38\frac{1}{2}-\frac{4x+12y}{10}$

$$10x+10y=382-4x-12y$$
$$14x+22y=382$$

Now (b) $21x+22y=452$

∴ by subtracting $7x = 70$

$$x = 10 \quad \text{Ans.}$$

Hence $y = 11$ Ans.

(2.) $\frac{1}{x-1}-\frac{1}{x-3}=\frac{1}{35}$

$$35(x+3-x+1)=(x-1)(x+3)$$
$$140=x^2-3+2x$$
$$x^2+2x=143$$

Completing square $x^2+2x+1=144$

taking root $x+1=\pm 12$

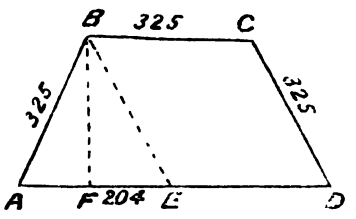
$$\therefore x=\pm 12-1=11 \text{ or } -13. \quad \text{Ans.}$$

Mensuration.

MALES.

Answer one Question.

1. ABCD is a four-sided figure; BC is parallel to AD; AB =BC=CD=325 feet; and AD=733 feet; find the area.



Through B draw BE parallel to CD, then ABE is an isosceles triangle, and the perp. BF bisects the base AE, which =733—325=408; therefore AF or FE = 204.

Wherefore $BF^2=AB^2-AF^2$
$=325^2-204^2$
$=64009$

And $BF=\sqrt{64009}=253$ ft.

Hence the area of the whole figure

$$253\times(733-204)=253\times 529$$
$$=133837 \text{ sq. ft.} \quad \text{Ans.}$$

2. The span of a bridge, whose form is the arc of a circle, being 96 feet, and the height being 12 feet, find the radius.

Rule.—Divide the square of half the span, *i.e*, 48 ft, by the height of the arc, 12 ft.; this quotient is the difference between the height of the arc and the diameter.

$\frac{48\times 48}{12}=192$ ft.; $192+12=204$ ft., the diameter.

half of 204 = 102 ft., the radius. Ans.

Needlework.

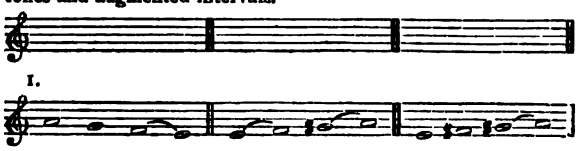
FEMALES.

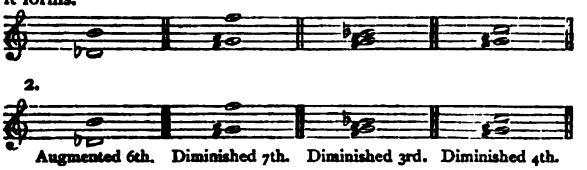
One hour allowed for this Exercise.

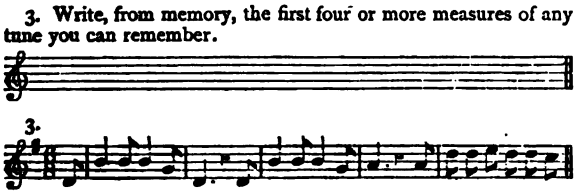
Music.

A quarter of an hour allowed for this Paper.

1. Write the upper tetrachord of A (*La*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.

3. Write, from memory, the first four or more measures of any tune you can remember.



The 'Health at School' Story or Essay Competition.

THE prize, Five Guineas, in this competition has been awarded to

NOVICE,

Thomas Knapman, 5, Avenue Villas, Winchester.

Other competitors—Nil Desperandum I., Nil Desperandum II., Junius Jose.

A. CARPENTER, M.D., *Judge.*

Query Column.

☞ **As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'**

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

General.

1. NOVICE.—(1) *Norman Lockyer's* 'Astronomy,' (Primer 1s.), (Larger book, 4s. 6d.), (Macmillan and Co.); (2) *Gardner's* 'How to Draw a Map,' 1s. (Hughes).

2. NAIVETE.—The solution of your query appeared in the March number.

3. LIBER.—Your question appeared in our issue for May.

4. Ex. P. T. (J. W.).—There are editions published by Gall and Inglis, and by the National Society.

5. G., Kingston.—You will notice that your query was sent by another correspondent.

6. INQUIRER.—Your query was forwarded previously by another correspondent. Any good algebra will give you a full explanation of 'Scales of Notation.'

7. PEEPING TOM, Coventry.—(1) No charge is made for answering queries; (2) Civil Service Commissioners, Cannon Row, S.W.

8. G. C.—'Seeing him pass, I called him in.'

Seeing.....Part. Imperf. from the verb 'to see,' trans. act., qual. the pro. 'I.'
him.....Pro., pers., 3rd, mas., sing., obj. by the participle 'seeing.'
pass .....Verb, reg., intrans., infin., indef. tense, and governed by the participle 'seeing.'

The phrase 'seeing him pass' is an enlargement of the subject 'I.'

9. MIZPAH.—A billion is a million million; a trillion is a million billion, etc.

In the foreign system of numeration, a thousand million is called a billion, a thousand billion a trillion, and so on.

10. LEO.—The barometer simply informs us what is the pressure exerted by the air at any time and place. This pressure is found to exhibit very great variations from time to time, and one of these is the moisture or dryness of the air. Moist air—that is, air charged with watery vapour—is found to weigh less than an equal bulk of dry air. This seems strange, but the barometer shows us that it is so; and we have a further proof of the fact if we observe the smoke from a chimney. On a fine day the air is heavy, and buoys it up in an almost straight line, while on a damp day it falls heavily. When, therefore, the air is charged with vapour, its pressure diminishes and the barometer therefore falls. We have thus this general rule:—When the barometer is low, wet or windy weather may be expected; and, on the contrary, when it is high, the weather will not improbably be fine.

There are three things which mainly affect the height of the mercury. These are:—

(1) The force of the wind, which produces variations occasionally amounting to as much as two inches.

(2) The amount of moisture in the air. The variations from this cause amount to about half an inch.

(3) The direction of the wind; a north-east wind having a tendency to cause a rise, and a south-west wind a fall. These variations likewise amount to about half an inch.

From this it will be seen that wind affects the barometer much more than moisture does. It is important, then, to notice, together with the height of the barometer, the direction of the wind, and likewise the temperature at the time of taking the observation, as mercury is very sensitive to heat, and expands considerably by it, thereby becoming lighter.

11. STUDENT, Northampton.—The solution of your query appeared in the February No.

12. DANIELL.—

We, pers. pron. 1st pers. com gen., plur., nom. case, subject to verb *are told.*
are told, weak verb, pass. ind. pres. 1st per. plural to agree with its subject *we.*
not, adverb of negation qualifying *are told.*
whither, conjunctive adverb of place, qualifying verb *went* and connecting the sentence *we are not told* to sentence *he went after*, etc.
he, pers. pronoun, 3rd pers. mas. gen. sing. numb. and nom. case to verb *went.*
went, strong intrans. verb. indic. mood, pres. tense, 3rd pers. sing. to agree with its subject *he.*
after, conjunction of time connecting the sentence *he was lost sight of* to the sentence *he went.*
he, personal pronoun, 3rd pers. sing. num. masc. gend. and nom. case to the verb *was lost.*
was lost sight of, trans. weak verb. ind. mood, past tense, 3rd pers. sing. to agree with its subject *he.*
sight may be separately parsed as a noun, and
of as an adverb.

13. LA GRAMMAIRE.—

Any (Saxon œnig), is a derivative from *án, one*
But (A. S. *bútan* or *bíton*), means literally 'on the outside of,' being a compound of *be, li* or *by*, and *útan*, outside.
else, is really *elles*, the genitive of a root *el* or *al*, meaning *other.*

either, is the modern form of the Saxon *aegther*, and means *each of two*, or *on either side one*.
its, is comparatively of modern origin. The old form was *his*, the possessive form of the Anglo-Saxon *hit*.
notwithstanding,=not standing against or opposing.
rather, literally means *earlier*, is the Anglo-Saxon, *rathor*, comparative of *rath*, *early*.
therefore, for that reason, from A.S. *thær*, *thære*, genitive and dative of *that*.
thrice, means 'three times,' and is the Old English genitive *thries*.
which, is equivalent to Latin *qualis*, and is a compound of *hwi*, or *hwy*, and *lic*, *like*, in Old English was written *whilk*.
what, the neuter of *who* (A.S. hwæt).
yours, belonging to you, is possessive (*eower*) of A.S. *eow*, you.

14. CYMRO.—We should advise you to go through Part V. as it contains a carefully graduated series of exercises based on the book you have already done.
We do not know of any book especially devoted to scanning and parsing. There are chapters on these subjects in most grammars. We will, however, make inquiries.

15. MABEL.—The spouseless Adriatic mourns for her lord, and, her annual marriage (ceremony) being no longer renewed, the Bucentaur, a neglected garment of her widowhood, lies rotting unrestored. St. Mark still sees his lion standing in its old position, but now in mockery of its withered power, over the proud Place where an Emperor sued, and where, when Venice was a queen with an unequalled dowry, monarchs gazed and envied.

16. PUZZLED.—M. Littré says in his large dictionary that the pronunciation of *onze* as if it were preceded by an aspirate arises from the tendency in old French to prefix an *h* to monosyllabic words, and those also in which only one syllable is emphasized, if they commence with a vowel. This, therefore, will account for the *e* of *le* not being elided before *onze*.

17. T. PRICE.—Our days will be calm, our nature bright and happy, when love proves unerring and joy is its own safeguard. They, even now, may hold a blissful course, who, not foolishly bold, live according to the spirit of this creed, and find, in proportion to their need, that other strength (in Religion or in Duty).

18. E. A. LL.—The 'Class-book of Modern Geography' (Philip) is well up to date. We know of none dealing only with Africa. All the latest information with respect to discoveries, etc., will be found embodied in the Report of the Royal Geographical Society, to be obtained, we think, on application to the Secretary, 1, Savile Row, W.

19. CONSTANT READER (Sutton Coldfield).—*Mason* 'English Grammar,' 3s. 6d. (Bell and Sons). *Meiklejohn's* 'History of English Language' (Stewart). *Angus's* 'English Literature' (Religious Tract Society). *Morris's* 'Historical Outline of English Accidence' (Macmillan) is a most useful book.

20. DOUBTFUL.—(*a*) Yes. (*b*) Your writing lacks vigour.

21. J. BARAGWANATH.—At a very early period of our history the King's Court, or *Aula Regis*, sent forth offshoots to relieve itself of certain sorts of cases. One branch, the *Court of Exchequer*, dealing with the Revenue, can be traced back to the reign of Henry I. Another, the Court of Common Pleas, seems to to have originated in that of Richard I. The rolls of the *King's Bench*, formed directly from the *Aula Regis*, date from the same reign.

The Court of Chancery is supposed to have first *definitely* entered upon its career as a Court of Equity in the reign of James I., when the king, speaking in the Star Chamber, said: 'Where the rigour of the law in many cases will undo a subject, then the Chancery tempers the law with equity, and so mixes mercy with justice, as it preserves a man from destruction.' The king gave a practical turn to his words by deciding in favour of Lord Ellesmere when Coke disputed the right of the Chancery to give relief against a judgment obtained by gross fraud and imposition in the Court of Queen's Bench.

22. CANTABRIGIA.—The following will doubtless prove useful:—'Lectures on General Jurisprudence,' by the late *John Austin*, 4th Edition (John Murray). Student's Edition of same, by *Robert Campbell* (John Murray). 'Analysis of Austin's Lectures,' by *Gordon Campbell* (John Murray). 'Institutes of Justinian' (Longmans). 'Institutes of Gaius' (Clarendon Press). *Maine's* 'Ancient Law (Murray). *Hallam's* 'Constitutional History of England' (Murray).

23. W. R.—The following will perhaps make your list more complete:—*Harrison's* 'Conic Sections and Analytical Geometry (Stewart), or *Hann's* 'Analytical Geometry and Conic Sections' (Weale's Series); *Gase's* '1st and 2nd French Books,' and *Davies'* 'Historical Manuals' for the Special Period.

24. O. D. V.—No, certainly not, he cannot be admitted.

25. TRAINING COLLEGE.—(1) Write to Secretary, Borough Road Training College, S E. (2) Via Latina.

26. LENA.—(1) The managers to whom the school belongs have a right to determine the character of the religious teaching. (2) No distinction is *now* made, but certificated teachers of the third class may take charge of schools of less than 60.

27. SUBSCRIBER, Arbroath.—No; a certificate must be produced from some competent authority stating that the candidate has sufficient knowledge of music.

28. QUEENIE.—St. V. and VI., but we refer you to Art. 40, New Code, for fuller information.

29. SEDGEMOOR.—The boy must be presented in Ex. St. VI. Consult your inspector.

30. J. W. C. A.—There is now no difference. All the necessary subjects must be taken.

31. CONSTANT READER, South Molton.—Will not be published till the close of the year by Messrs. Longmans.

32. A NON-PUPIL-TEACHER.—No; not as a scholar.

33. SHORT SIGHT.—Each case of defect is decided by the medical adviser of the college.

34. M. STEVENSON.—The new Code will be applied in such a case next December.

35. T. D.—'Mental Arithmetic,' *Mansford* (Hughes); 'English Language,' *Angus* (Religious Tract Society); or *Morris* (Macmillan and Co.)

36. FOLKESTONIAN.—Supposing the earth to revolve round the sun in 365·242264 days, explain why leap day should be omitted once in each of three centuries out of every four.

$$365{\cdot}25 - 365{\cdot}242264 = {\cdot}007736.$$

In 400 years this makes a difference of $\cdot 007736 \times 400$ or 3·0944 days. We thus see that in 400 years three leap days must be omitted.
Pope Gregory ordered that three of the leap years in every 400 years should be omitted, viz., those which complete a century, the numbers expressing which century, are *not* divisible by four; thus 1600 and 2000 are leap years, but 1700, 1800, and 1900 are not leap years.

Arithmetic.

1. COURCELLES.—A and B together do a piece of work in 11 days, A and C do the same piece of work in 5 days, B and C together do it in 8 days: how long would it take each to do it separately?

A and B can do the work in 11 days,
A ,, C ,, ,, 5 ,,
B ,, C ,, ,, 8 ,,
∴ A ,, B can do in 1 day $\frac{1}{11}$ of the work,
A ,, C ,, ,, $\frac{1}{5}$,, ,,
B ,, C ,, ,, $\frac{1}{8}$,, ,,

∴(By addition)
2(A, B, and C) can do in 1 day $(\frac{1}{11}+\frac{1}{8}+\frac{1}{5})$ of the work.
$= \frac{40+88+55}{440}$ " "
$= \frac{183}{440}$ of the work;
∴A, B, and C " " $(\frac{183}{440}\div 2)$ of the work
$= \frac{183}{880}$ " "
∴ A can do in 1 day $(\frac{183}{880}-\frac{1}{8})$ of the work $= \frac{73}{880}$ of the work,
B " " $(\frac{183}{880}-\frac{1}{5})$ " " $= \frac{7}{176}$ " "
C " " $(\frac{183}{880}-\frac{1}{11})$ " " $= \frac{103}{880}$ " "
∴ A can do the work in $\frac{880}{73}$ days $= 12\frac{4}{73}$ days,
B " " $\frac{880}{7}$ " $= 125\frac{5}{7}$ "
C " " $\frac{880}{103}$ " $= 8\frac{96}{103}$ "
} Ans.

2. G. T. D., Grimsby.—A woman sold 8 dozen apples for 7s. $6\frac{3}{4}$d. Some were sold at the rate of 4 for $3\frac{1}{2}$d. and some at 10 for 11d. How many were sold at each rate?

Average selling price $= \frac{7s.\ 6\frac{3}{4}d.}{96} = \frac{90}{96}q. = \frac{15}{16}q.$

Selling price of each in 1st lot $= \frac{3\frac{1}{2}d.}{4} = \frac{7}{8}d. = \frac{7}{8}q.$

" " 2nd " $= \frac{11d.}{10} = \frac{11}{10}q. = \frac{22}{20}q.$

Difference between average price and price of those in 1st lot
$= (\frac{15}{16}-\frac{7}{8})q. = \frac{121-112}{32}q. = \frac{9}{32}q.$

Difference between average price and price of those in 2nd lot
$= (\frac{22}{20}-\frac{15}{16})q. = \frac{704-605}{160}q. = \frac{99}{160}q.$

∴No. in 1st lot : No. in 2nd lot :: $\frac{99}{160} : \frac{9}{32}$
:: 99 : 45
:: 11 : 5.
11+5=16. 8 dozen ÷ 16 = $\frac{1}{2}$ dozen.
∴No. in 1st lot = $\frac{1}{2}$ dozen × 11 = $5\frac{1}{2}$ dozen,
" 2nd. " = " × 5 = $2\frac{1}{2}$ "
} Ans.

3. KONIEH.—A person, who has invested a certain sum of money for $3\frac{1}{2}$ years at $4\frac{1}{2}$ per cent., finds that, if he had invested it and £100 more for 3 years at 5 per cent., the interest would have been more by £11 5s. than it is now. How much did he invest?

Interest on £100 in 1st case = £$4\frac{1}{2} \times 3\frac{1}{2}$ = £$15\frac{3}{4}$,
" " 2nd " = £5 × 3 = £15;
Difference of interests on £100 = £$\frac{3}{4}$;
But difference of interests on the sum invested = £15 − £11 5s.
= £$3\frac{3}{4}$:
∴ Sum invested = £$100 \times \frac{3\frac{3}{4}}{\frac{3}{4}}$
= £100 × 5
= £500. Ans.

4. GEORGINA.—A man expends £1000 in the purchase of Great Nugget shares of £5, when they are at 2 premium, and £500 in the purchase of Agua Frias of £2, when they are at $\frac{1}{4}$ discount; he sells out again when the Nuggets fall to par and the Agua Frias rise to 3 premium. What does he gain or lose, after paying the broker $\frac{1}{4}$ per cent. on all the money which passes through his hands? (*Barnard Smith.*)

Brokerage in 1st case = $\frac{1}{4}$ p. c. on £1000 = £$2\frac{1}{2}$;
∴ No. of Great Nugget shares = (£1000 − £$2\frac{1}{2}$) ÷ £7
= $997\frac{1}{2} \div 7$
= $142\frac{1}{2}$.
Brokerage in 2nd case = $\frac{1}{4}$ p. c. on £500 = £$1\frac{1}{4}$;
∴ No. of Agua Frias = (£500 − £$1\frac{1}{4}$) ÷ £$(2-\frac{1}{4})$
= $498\frac{3}{4} \div 1\frac{1}{4}$
= $1995 \div 5$
= 399.
Selling price of Great Nugget shares = $(142\frac{1}{2} \times 5)$£,
" " " Agua Frias = (399×5)£,
∴ Total selling price = $(541\frac{1}{2} \times 5)$£
= £$2707\frac{1}{2}$;
Brokerage = $\frac{1}{4}$ p. c. on £$2707\frac{1}{2}$
= £6·76875
= £6 15s. $4\frac{1}{2}$d.;
∴ Gain = £2707 10s. − £6 15s. $4\frac{1}{2}$d. − £1500
= £1200 14s. $7\frac{1}{2}$d. Ans.

5. YELSERP.—A has £90,000 stock in the 3 p. c. South Sea Annuities, and is offered by Government the choice of being paid off at par at the end of the year, or of receiving £110 of a new $2\frac{1}{2}$ per cent. stock for each £100. He chooses the former alternative, and, on being paid off, is able to invest his money in the 3 per cent. consols at 92. Find the amount of his stock in consols, and the excess of his income above what it would have been if he had agreed to the proposed conversion. (*Barnard Smith.*)

Amount of stock in consols = £$90{,}000 \times \frac{100}{92}$
= £$\frac{225{,}000}{23}$
= £$97{,}826\frac{2}{23}$. Ans.

Income in 1st case = £$90{,}000 \times \frac{110}{100} \times \frac{2\frac{1}{2}}{100}$
= £(275 × 9)
= £2475;
" " 2nd " = £$90{,}000 \times \frac{3}{92}$
= £$\frac{67{,}500}{23}$
= £$2934\frac{18}{23}$;
∴ Excess in income = £$2934\frac{18}{23}$ − £2475
= £$459\frac{18}{23}$ Ans.

6. BOREAS.—A waggon leaves London for Oxford at 5.30 a.m., and travels at the rate of 6 miles an hour. A coach, whose rate is to that of the waggon as 5 is to 3, leaves London some time after, also for Oxford, overtakes the waggon at 10.30 a.m., and proceeds to its destination, where, after remaining an hour, it commences its return journey, and meets the waggon $3\frac{3}{4}$ miles from Oxford. Find the distance between London and Oxford, and the time (1) when the coach leaves London, (2) when it arrives in Oxford, (3) when it meets the waggon, and (4) when it arrives in London; also the time when the waggon arrives in Oxford.

Rate of coach per hour = $\frac{5}{3}$ of six miles = 10 miles.
Distance gone by waggon when overtaken by coach
= (5 × 6) miles = 30 miles;
Time taken by coach to travel this distance = $\frac{30}{10}$ hours
= 3 hours;
∴ Coach left London at 7.30 a.m. (1). Ans.

Coach meets waggon $3\frac{3}{4}$ miles from Oxford, after remaining 1 hour,
∴ Coach goes $7\frac{1}{2}$ miles farther than waggon, and 1 hour to spare,
∴ Coach could go $17\frac{1}{2}$ miles farther than waggon in the time;
But coach gains (10 − 6) or 4 miles an hour;
∴ Time it takes waggon to travel from the place where overtaken by coach to $3\frac{3}{4}$ miles from Oxford
= $(17\frac{1}{2} \div 4)$ hours = $4\frac{3}{8}$ hours;
∴ Distance from London to Oxford = $(4\frac{3}{8} \times 6 + 3\frac{3}{4} + 30)$ miles
= $(26\frac{1}{4} + 3\frac{3}{4} + 30)$ miles
= 60 miles. Ans.

∴ Coach arrives in Oxford in 6 hours, that is, at
1.30 p.m. (2). Ans.

∴ Coach meets waggon at 10.30 a.m. + $4\frac{3}{8}$ hours
= 10.30 a.m. + 4 hrs. $22\frac{1}{2}$ min.
= 2.52$\frac{1}{2}$ p.m.
= $7\frac{1}{2}$ min. to 3 p.m. (3). Ans.

∴ Coach arrives in London at 8.30 p.m. (4). Ans.

∴ Waggon arrives in Oxford in 10 hours, that is at
3.30. p.m. Ans.

7. BIRDIE.—If a cottager spends 8s. a week on flour, what difference will it make to him if the wheat rises from £2 10s. 4d. to £2 15s. $1\frac{1}{2}$d. per quarter, if flour rise in the same proportion?

$$\frac{\text{£2 15s. } 1\frac{1}{2}\text{d.} - \text{£2 10s. 4d.}}{\text{£2 15s. } 1\frac{1}{2}\text{d.}} = \frac{\text{4s. } 9\frac{1}{2}\text{d.}}{\text{£2 15s. } 1\frac{1}{2}\text{d.}} = \frac{459}{5291};$$

∴ He will obtain $\frac{4832}{5291}$ less than formerly, or $\frac{459}{5291}$ of 8s., or 7s. $3\frac{1}{2}$d. $\frac{459}{5291}$ q. worth for 8s. Ans.

Note.—32 pecks = 1 quarter.

8. MATHEMATICIAN.—The weekly receipts of a railway company average £2683 7s. 6d. from passenger, and £2117 8s. from goods traffic. The expenses of working are £13,303 7s. 2d. per calendar month. Their capital is 2 millions: what interest can they pay per share of £100? (Barnard Smith.)

Annual receipts = (£2683 7s. 6d. + £2117 8s.) × 52
= £4800 15s. 6d. × 52
= £249,640 6s.
,, expenses = £13,303 7s. 2d. × 12
= £159,640 6s.
Net receipts = £249,640 6s. − £159,640 6s.
= £90,000;

$$\therefore \text{Dividend} = £90{,}000 \times \frac{100}{2{,}000{,}000}$$
$$= £4\tfrac{1}{2}$$
$$= 4\tfrac{1}{2} \text{ per cent.} \quad \text{Ans.}$$

9. E. N.—A person has £2950 in the 3 per cents. at 83½; when the funds have fallen 2½ per cent., he transfers his capital into the 5 per cents. at 108; find the alteration in his income.

Income in 1st case = 3% on £2950
= £29 10s. × 3
= £88 10s.

$$\text{Stock in 2nd case} = £2950 \times \frac{83\frac{1}{2} - 2\frac{1}{2}}{108}$$
$$= £2950 \times \frac{81}{108}$$
$$= £2950 \times \frac{3}{4}$$
$$= £2212\ 10s.$$

Income in 2nd case = 5% on £2212 10s.
= £110 12s. 6d.
∴ Alteration in income = £110 12s. 6d. − £88 10s.
= £22 2s. 6d. increase. Ans.

10. J. EDWARDS, Burton-on-Trent.—Two bottles of sherry and six pints of ale cost 12s. If the price of the sherry rose 10 per cent., and that of the ale 50 per cent., the cost would be 14s. What was the original price of a bottle of sherry and of a pint of ale?

Cost of 2 bottles of sherry + cost of 6 pints of ale = 12s.
Cost of 2 bottles of sherry (increased $\frac{1}{10}$) + cost of 6 pints of ale (increased $\frac{1}{2}$) = 14s.
∴ Cost of 2½ bottles of sherry + cost of 9 pints of ale = 14s.

(1) ,, 2 ,, ,, + ,, 6 ,, ,, = 12s.
(2) ,, 2½ ,, ,, + ,, 9 ,, ,, = 14s.
(1) × 3, ,, 6 ,, ,, + ,, 18 ,, ,, = 36s.
(2) × 2, ,, 4½ ,, ,, + ,, 18 ,, ,, = 28s.

Subtracting, Cost of 1½ bottles of sherry = 8s.
∴ Cost of a bottle of sherry = 8s. × ⅔
= 5s. Ans.

Cost of 1 bottle of sherry + cost of 3 pints of ale = 6s.
Cost of 3 pints of ale = 1s.
∴ Cost of a pint of ale = 4d. Ans.

11. N. LEIGH.—If incomes above £150 pay 7d. in the pound income tax, and incomes below £150 pay 5d. in the pound, what income above £150 is practically equal to £149 19s. 11¼d.? (*Mansford's* 'Arithmetic.')

s. d.		£ s. d.		s. d.	
19 5	:	149 19 11¾	::	19 7	: Income.
12		235		12	
233		35249 15 1¼		235	

233 | 35249 15 1¼ (£151 235
1194
1165
299
233
66
20
1335 (5s.
1165
170
12
2041 (8d.
1864
177

$$177\tfrac{1}{4} = \tfrac{709}{4}\text{d.}$$
$$\frac{709}{4} \div 233 = \frac{709}{932}\text{d.}$$

∴ Income = £151 5s. $8\frac{709}{932}$d. Ans.

12. CYMRO GLAN GLOEW.—If 29 oxen would eat up a field of grass in 7 weeks, or 25 oxen would eat up the same field in 9 weeks, the grass growing uniformly, in what time would 32 oxen eat it?

The quantity eaten in 9 weeks by 25 oxen would last (25 × 9) or 225 oxen for 1 week;
The quantity eaten in 7 weeks by 29 oxen would last (29 × 7) or 203 oxen for 1 week;
∴ Quantity grown in 2 weeks would last (225 − 203), or 22 oxen for 1 week;
∴ The growing grass supplies 11 oxen.
∴ Time it would take 32 oxen to eat the grass of the field

$$= 7 \text{ weeks} \times \frac{29 - 11}{32 - 11}$$
$$= \tfrac{18}{21} \text{ of } 7 \text{ weeks.}$$
$$= 6 \text{ weeks.} \quad \text{Ans.}$$

Note.—(*a*) Writing very fair. (*b*) Yes.

Algebra.

1. SOCRATES.—By selling a horse for £171 I gain as much per cent. as the horse cost me. What was its cost?

Let x = cost of horse in pounds;

$$\therefore x + \left(x \times \frac{x}{100}\right) = 171$$
$$x + \frac{x^2}{100} = 171$$
$$x^2 + 100x = 17{,}100$$
$$x^2 + 100x + (50)^2 = 17{,}100 + 2{,}500$$
$$= 19{,}600$$
$$x + 50 = 140$$
$$x = 140 - 50$$
$$\therefore x = 90.$$

∴ Cost of horse = £90. Ans.

2. W. GREENWOOD.—A merchant buys flannel at 16 pence a yard, and sells it at such a price that he gets for 220 yards as much as he gains per cent. Find his gain per cent.

Let x = gain per cent.;

Cost price of 220 yards = (16 × 220)d.
= 3520d.
= £$\frac{44}{3}$;

$$\therefore \tfrac{44}{3} + \left(\frac{44}{3} \times \frac{x}{100} \times \frac{11}{25}\right) = x$$
$$\tfrac{44}{3} + \frac{11x}{75} = x$$
$$1100 + 11x = 75x$$
$$75x - 11x = 1100$$
$$64x = 1100$$
$$\therefore x = \tfrac{1100}{64}$$
$$= 17\tfrac{12}{16}.$$

∴ Gain per cent. = $17\frac{3}{16}$. Ans.

3. H. W. J.—Extract the square root of 105,404·440241 in the scale o 6, and express the result in the duodenary scale.

10'54'04'44'02'41 (234'521
4
43 | 254
213
504 | 4104
3224
5125 | 44044
42121
51342 | 152302
143124
513441 | 513441
513441

12 | 234
12 | 11...10
0... 7

$$\text{·}521 = \tfrac{5}{6} + \frac{2}{6^2} + \frac{1}{6^3}$$
$$= \frac{180 + 12 + 1}{216} = \tfrac{193}{216};$$
$$\tfrac{193}{216} \times 12 = \tfrac{193}{18} = 10\tfrac{13}{18},$$
$$\tfrac{13}{18} \times 12 = \tfrac{13}{3} = 8\tfrac{1}{3},$$
$$\tfrac{1}{3} \times 12 = 8.$$

∴ 234·521 in the scale of 6 = 7t'·88 in the scale of 12. Ans.

4. H. J. BIFFEN.—Solve:—

$$\left.\begin{aligned} x^2+y &= 18 \\ x+y^2 &= 8 \end{aligned}\right\}$$

$$\left.\begin{aligned} x^2+y &= 18 \\ x+y^2 &= 8 \end{aligned}\right\}$$

$$x^2-x+y-y^2 = 10$$
$$x^2-y^2-x+y = 10$$
$$(x+y)(x-y)-(x-y) = 10$$
$$(x+y-1)(x-y) = 10$$
$$= 5\times 2;$$

If we take, $x+y-1=5$, and $x-y=2$, we obtain the values:—$\underline{x=4 \text{ and } y=2.}$

5. EVENLODE.—Solve:—

$$a\frac{a-x}{b}-b\frac{b+x}{a}=x.$$

$$a\frac{a-x}{b}-b\frac{b+x}{a}=x$$
$$a^2(a-x)-b^2(b+x)=abx$$
$$a^3-a^2x-b^2-b^2x=abx$$
$$-a^2x-b^2x-abx=-a^3+b^3$$
$$(a^2+ab+b^2)x=a^3-b^3$$
$$\therefore \underline{x=a-b.}$$

6. TRECH CYMRO NA SAIS.—Solve:—

$$\left.\begin{aligned} x+y+z &= 11 \\ x^2+y^2+z^2 &= 49 \\ 2(z-y) &= 3x \end{aligned}\right\}$$

$$\left.\begin{aligned} (1)\quad x+y+z &= 11 \\ (3)\quad 2z-2y &= 3x \end{aligned}\right\}$$

$$\left.\begin{aligned} (1)\ 2x+2y+2z &= 22 \\ (3)-3x-2y+2z &= 0 \end{aligned}\right\}$$

Adding, $-x+4z=22$

$$\therefore \underline{z=\frac{22+x}{4}}$$

Subtracting, $5x+4y=22$

$$\therefore \underline{y=\frac{22-5x}{4}}$$

(2) $x^2+y^2+z^2=49$

$$x^2+\left(\frac{22-5x}{4}\right)^2+\left(\frac{22+x}{4}\right)^2=49$$
$$x^2+\frac{484-220x+25x^2+484+44x+x^2}{16}=49$$
$$x^2+\frac{968-176x+26x^2}{16}=49$$
$$8x^2+484-88x+13x^2=392$$
$$21x^2-88x=392-484$$
$$=-92$$
$$x^2-\frac{88x}{21}=-\frac{92}{21}$$
$$x^2-\frac{88x}{21}+(\tfrac{44}{21})^2=-\tfrac{92}{21}+\tfrac{1936}{441}$$
$$=\frac{1936-1932}{441}$$
$$=\tfrac{4}{441}$$
$$x-\tfrac{44}{21}=\pm\tfrac{2}{21}$$
$$x=\pm\tfrac{2}{21}+\tfrac{44}{21}$$
$$\therefore \underline{x=\tfrac{46}{21} \text{ or } 2.}$$

$$y=\frac{22-5x}{4}$$
$$=\frac{22-5\times\frac{46}{21}}{4} \text{ or } \frac{22-5\times 2}{4}$$
$$=\frac{22-\frac{230}{21}}{4} \text{ or } \frac{22-10}{4}$$
$$=\tfrac{232}{84} \text{ or } \tfrac{12}{4}$$
$$=\underline{\tfrac{58}{21} \text{ or } 3.}$$

$$z=\frac{22+x}{4}$$
$$=\frac{22+\frac{46}{21}}{4} \text{ or } \frac{22+2}{4}$$
$$=\tfrac{508}{84} \text{ or } \tfrac{24}{4}$$
$$=\underline{\tfrac{127}{21} \text{ or } 6.}$$

$$\therefore \underline{x=2 \text{ or } 2\tfrac{4}{21},\ y=3 \text{ or } 2\tfrac{16}{21},\ z=6 \text{ or } 6\tfrac{1}{21}.}$$

7. MATHEMATICIAN.—Solve:—

$$\left.\begin{aligned} xy &= x+y \\ xz &= 2(x+z) \\ yz &= 3(y+z) \end{aligned}\right\} \text{ (Colenso.)}$$

(1) $xy=x+y$
$xy-y=x$
$(x-1)y=x$
$\therefore \underline{y=\frac{x}{x-1}.}$

(2) $xz=2(x+z)$
$xz-2z=2x$
$(x-2)z=2x$
$\therefore \underline{z=\frac{2x}{x-2}.}$

(3) $yz=3(y+z)$

$$\frac{x}{x-1}\times\frac{2x}{x-2}=3\left(\frac{x}{x-1}+\frac{2x}{x-2}\right)$$
$$\frac{2x^2}{x^2-3x+2}=3\left(\frac{x^2-2x+2x^2-2x}{x^2-3x+2}\right)$$
$$2x^2=3(3x^2-4x)$$
$$=9x^2-12x$$
$$2x^2-9x^2=-12x$$
$$-7x^2=-12x$$
$$7x=12$$
$$\therefore \underline{x=1\tfrac{5}{7}.}$$

$$y=\frac{x}{x-1}=\frac{1\frac{5}{7}}{1\frac{5}{7}-1}=\tfrac{12}{5}=2\tfrac{2}{5}.$$
$$\underline{z=\frac{2x}{x-2}=\frac{2\times 1\frac{5}{7}}{1\frac{5}{7}-2}=\frac{24}{-2}=-12.}$$

8. MATHEMATICIAN.—Simplify:—

$$\left\{ x^{\frac{3}{2}}y^{-\frac{1}{2}}\sqrt{\left(x^{\frac{1}{2}}y^{\frac{1}{2}}\sqrt{y^{\frac{1}{2}}}\right)}\right\}^3 \text{ (Colenso.)}$$

$$\left\{ x^{\frac{1}{2}}y^{-\frac{1}{2}}\sqrt{\left(x^{\frac{1}{2}}y^{\frac{1}{2}}\sqrt{y^{\frac{1}{2}}}\right)}\right\}^{\frac{3}{2}}$$
$$=x^{\frac{3}{2}}y^{-\frac{3}{4}}\sqrt{\left(xy^{\frac{3}{2}}\sqrt{y}\right)}$$
$$=x^{\frac{3}{2}}y^{-\frac{3}{4}}\sqrt{\left(xy^{\frac{3}{2}}\times y^{\frac{1}{2}}\right)}$$
$$=x^{\frac{3}{2}}y^{-\frac{3}{4}}\sqrt{xy^2}$$
$$=x^{\frac{3}{2}}y^{-\frac{3}{4}}\times x^{\frac{1}{2}}y$$
$$=\underline{x^2y^{\frac{1}{4}}.} \text{ Ans.}$$

9. J. BARAGWANATH.—Solve:—

$$\sqrt{1+x+x^2}+\sqrt{1-x+x^2}=3x. \text{ (Hall's 'Algebra.')}$$
$$\sqrt{1+x+x^2}+\sqrt{1-x+x^2}=3x$$
$$1+x+x^2+2\sqrt{(1+x+x^2)(1-x+x^2)}+1-x+x^2=9x^2$$
$$2\sqrt{1+x^2+x^4}=9x^2-2x^2-2$$
$$=7x^2-2$$
$$4(1+x^2+x^4)=49x^4-28x^2+4$$
$$4+4x^2+4x^4=49x^4-28x^2+4$$
$$4x^4-49x^4=-28x^2-4x^2$$
$$-45x^4=-32x^2$$
$$45x^2=32$$
$$x^2=\tfrac{32}{45}$$
$$\therefore x=\pm\sqrt{\tfrac{32}{45}}$$
$$=\underline{\pm\tfrac{4}{15}\sqrt{\tfrac{2}{5}}.}$$

10. DISCO.—Find the sum of the series:—

$$21^2+22^2+\ldots\ldots+100^2$$

$$1^2+2^2+3^2+\ldots\ldots+n^2=\frac{n(n+1)(2n+1)}{6}$$

$$21^2+22^2+\ldots\ldots+100^2$$
$$=1^2+2^2+\ldots\ldots+100^2-(1^2+2^2+\ldots\ldots+20^2)$$
$$=\frac{100(100+1)(200+1)}{6}-\frac{20(20+1)(40+1)}{6}$$
$$=\frac{\overset{50}{\cancel{100}}\times 101\times\overset{67}{\cancel{201}}}{\underset{1}{\cancel{6}}}-\frac{\overset{10}{\cancel{20}}\times\overset{7}{\cancel{21}}\times 41}{\underset{1}{\cancel{6}}}$$
$$=338,350-2,870$$
$$=\underline{335,480.} \text{ Ans.}$$

11. ALPHA.—A train starts with its full complement of passengers. At the first station it drops one-third of these, and takes in 96 more; at the next it drops one-half of the new total, and takes in 12 more. On reaching the third station there are found to be 248 left. What number started?

Let x = no. of passengers at first,

Then $\frac{2x}{3}+96$ = no. left after first station;

$\therefore \frac{1}{2}\left(\frac{2x}{3}+96\right)+12=248$

$\frac{x}{3}+48+12=248$

$\frac{x}{3}=248-60$

$=188$

$\therefore x=564.$

$\therefore$ No. of passengers at first = 564. Ans.

Mensuration.

1. DEWI.—A cask weighing 2 cwt. 12 lbs. 4 oz. floats in a cubical cistern of water, whose side is five feet. On the removal of the cask find how much the water will sink in the cistern, supposing a cubical foot of water to weigh 63 lbs.

Surface of cistern = (5^2) sq. ft. = 25 sq. ft.

Space occupied by cask = $\frac{2 \text{ cwt. } 12 \text{ lbs. } 4 \text{ oz.}}{63 \text{ lbs.}}$ cub. ft.

$=\frac{236\frac{1}{4}}{63}$ cub. ft.

$=\frac{945}{252}$,,

$=\frac{15}{4}$,,

$\therefore$ The water will sink $(\frac{15}{4}\div 25)$ ft.

$=\frac{3}{20}$ ft.

$=\frac{9}{5}$ in.

$=1{\cdot}8$ in. Ans.

2. ZNERRUX.—A cylindrical reservoir, whose diameter is 10 feet and height $10\frac{1}{2}$ feet, is supplied by two pipes. One of them alone could fill it in 20 minutes, and water flows in through the other at the rate of 200 gallons a minute. If both pipes are opened simultaneously, how long will they take to fill the reservoir, supposing the volume of a gallon of water to be 277·25 cubic inches?

Content of reservoir = $(10^2 \times {\cdot}7854 \times 10\frac{1}{2})$ cub. ft.

$=(78{\cdot}54 \times 10\frac{1}{2})$,,

$=(785{\cdot}4+39{\cdot}27)$,,

$=824{\cdot}67$ cub. ft.

$\therefore$ Reservoir will hold $\frac{824{\cdot}67 \times 1728}{277{\cdot}25}$ gals.

$=14\frac{2}{3}\frac{9}{3}\frac{2}{3}\frac{3}{3}\frac{1}{3}\frac{2}{3}$ gals.

1st pipe will fill in one minute $(\frac{1}{20}$ of $14\frac{2}{3}\frac{9}{3}\frac{2}{3}\frac{3}{3}\frac{1}{3}\frac{2}{3})$ gals.

$=\frac{2}{1}\frac{9}{3}\frac{2}{3}\frac{3}{3}\frac{1}{3}\frac{2}{3}\frac{4}{0}$ gals.

Both pipes will fill in 1 min. $(200+\frac{2}{1}\frac{9}{3}\frac{2}{3}\frac{3}{3}\frac{1}{3}\frac{2}{3}\frac{4}{0})$ gals.

$=\frac{2}{1}\frac{2}{3}\frac{3}{3}\frac{4}{3}\frac{7}{3}\frac{2}{3}\frac{4}{0}$ gals.

$\therefore$ Reservoir will be filled by both pipes in

$(14\frac{2}{3}\frac{9}{3}\frac{2}{3}\frac{3}{3}\frac{1}{3}\frac{2}{3} \div \frac{2}{1}\frac{2}{3}\frac{3}{3}\frac{4}{3}\frac{7}{3}\frac{2}{3}\frac{4}{0})$ min.

$=\left(\frac{142502976}{\cancel{277}\cancel{25}} \times \frac{\cancel{25}\cancel{25}\cancel{25}}{63350744}\right)$ min.

$=11{\cdot}247\ldots$ min. Ans.

3. GULIELMUS.—A map is drawn on a scale of $\frac{1}{4}$ of an inch to the square mile, and is 6 feet 5 inches long and 3 feet 6 inches broad; find the area of a map drawn on a slate which is 15 inches long and 6 inches broad, on the largest scale which the slate will permit. Find also the scale on which it is drawn.

ft.	in.	in.	ft.	in.	
3	6	: 6	5		: To leng h of map on slate
12		12			
42		77			
7		11			

$=11$ in.

$\therefore$ Area of map on s'ate = (11×6) sq. in.

$=66$ sq. in. Ans.

Area of map = 6 ft. 5 in. × 3 ft. 6 in.

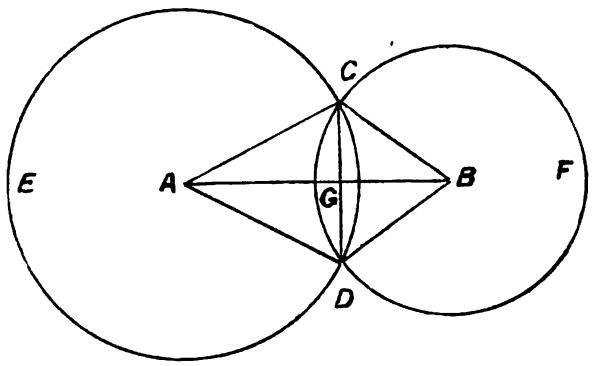
$=(77 \times 42)$ sq. in.

$\therefore$ Scale of map on slate = $\frac{6}{77 \times 42}$ of $\frac{1}{4}$ sq. in. to the sq. mile.

$=\frac{1}{1}\frac{1}{1}\frac{1}{1}$ sq. in. to the sq. mile. Ans.

Geometry.

1. O. H. F.—If two circles cut each other, the line joining their points of intersection is perpendicular to the line joining their centres.



Let the two circles CDE, CDF intersect at the points C, D, and let CD be joined, also A, B, the centres of the circles.

Then CD shall be perpendicular to AB.

Let G be the point of intersection of AB, CD, and draw AC, AD, BC, BD.

Proof—In the triangles CAB, DAB, the two sides CA, AB = the two sides DA, AB, each to each,

and the base BC = the base BD, (Def. 15.)

$\therefore \angle CAB = \angle DAB$. (I. 8.)

Again, in the triangles CAG, DAG, the two sides CA, AG = the two sides DA, AG, each to each,

and $\angle CAG = \angle DAG$,

$\therefore$ the base CG = the base DG, (I. 4)

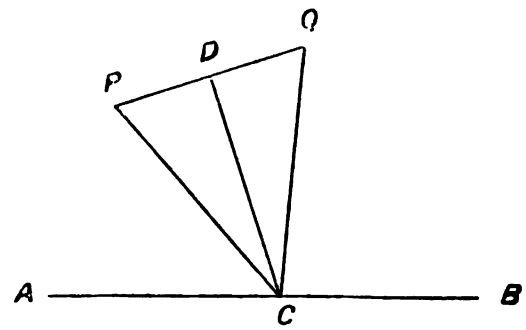
and $\angle AGC = \angle AGD$;

and these are adjacent angles;

$\therefore$ AG is perpendicular to CD. (Def. 10.)

Wherefore CD is perpendicular to AB. Q.E.D.

2. BRETWALDA.—Find the point C, in a given right line AB, from which two equal right lines can be drawn to two given points, P and Q.



Construction—Join PQ; bisect it in D, and from D draw DC at right angles to PQ, cutting AB in C.

Then C shall be the required point in AB.

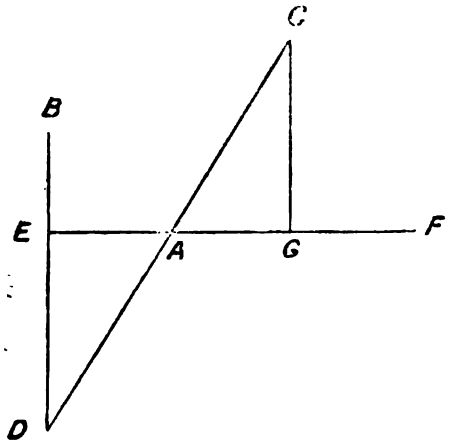
Join CP, CQ.

Proof.—In the triangles CDP, CDQ, the two sides CD, DP = the two sides CD, DQ, each to each,

and the angle CDP = the angle CDQ, (Ax. 11.)

$\therefore$ Base CP = base CQ. (I. 4.) Q. E. F.

3. J. GUILD.—Through a given point to draw a straight line, so that the parts of it intercepted between that point, and the perpendiculars upon it from other two given points, may be equal.



Let A, B, C be the three given points.

It is required to draw a straight line through A, so that the parts of it intercepted between A and the perpendiculars from B, C shall be equal.

Construction.—Join CA, and produce it to D, making AD equal to CA; join BD, and draw EAF perpendicular to BD.

Then EF shall be the required straight line.

Draw CG perpendicular to EF.

Proof.—In the triangles ACG, ADE,

∠ CAG = ∠ DAE, (I. 15.)

∠ CGA = ∠ DEA, (Ax. 11.)

and side CA = side DA, (Con.)

∴ side AG = side AE. (I. 26.) Q. E. F.

4. DANEBURGH.—Show that the square on the sum of two straight lines, together with the square on their difference, is double the squares on the two lines.

This is identical with Prop. X., Bk. II.

Monthly Notes.

LONDON SOCIETY FOR TEACHING THE BLIND.—The annual meeting of this society was held, lately, at Willis's Rooms, St. James's, and was numerously attended. Mr. Richardson Gardner, M.P., occupied the chair.—The Rev. C. Camp read the report, which stated that the number of pupils now in the school is 31 males and 26 females. Of the males, 3 are engaged in basket-making, 7 in chair-caning, 8 in piano-tuning, 12 are receiving musical instruction, and 3 are employed in the embossing department. Of the females, 13 are receiving musical instruction. The institution, the report stated, does not exercise any power of selection of the fittest candidates, but opens its doors to all who possess simple capacities for instruction.—The Chairman said, as some contradictory statements had appeared in the newspapers regarding the legacies left by Mr. Gardner, his father-in-law, for the benefit of the blind, it might be interesting that he should state exactly how the matter really stood. The amount of the legacy was £300,000, besides £10,000 each to three different institutions, of which this was one. A friendly suit was instituted in Chancery with regard to the £300,000, and a scheme had been propounded by the Court. The interest of the whole sum was about £9,000 a year, which, by the scheme, was to be divided into thirds—one-third to be devoted to musical instruction, one-third to instruction in handicrafts, and one-third in pensions for those who could not support themselves. He was himself somewhat of a specialist in matters relating to the blind, he having, in company with his wife, spent a twelvemonth in visiting the various institutions for the blind on the Continent, some of which were very well managed, but he believed there was none more efficiently managed than this.

YORKSHIRE COLLEGE.—It has been decided to found a chair of physics in the Yorkshire College, as a memorial to the late Lord Frederick Cavendish, who was for some time President of that institution.

NATIONAL UNION OF ELEMENTARY TEACHERS.—We take the following from Mr. Heller's report to the Executive of the National Union of Elementary Teachers:—'I have ascertained from the Secretary of the Education Department that the question as to the interpretation of the term "average attendance" under Arts. 15, 18, and 96 (*a*), (*b*), is still under consideration, and has not been definitely settled by the Department. I have also ascertained that the report of my previous interview with Sir Francis Sandford respecting the use of geographical readers and the revision of a member's certificate is substantially accurate. The member should be advised to forward his certificate to the Department through the managers. I have further to report that if a certificate has not been sent up for revision at the end of ten years it is open to the managers to submit it to the Department for that purpose. I am further authorised to say that during the transitional period the production of geographical readers will not be fully insisted upon if it can be shown that good text-books on the subject are in use. The Department have still under consideration the recognition of the geographical reader as one of the three sets required in a school. I also gather that Art. 113 (*b*), (i), and (iv) New Code, relating to evening schools, does not mean that a night school pupil may be examined if he has attended at all during the eight weeks. The wording of the article is somewhat obscure; but the intention of the Department is that the scholar should have been in attendance regularly during the period named.'

Gossip.

We beg to remind our readers that the new offices of the National Union of Elementary Teachers are at 57 and 58, Chancery Lane, W.C. The rooms placed at the disposal of the Union are light, commodious, and convenient, and form part of a noble building in the heart of the metropolis.

***

Secretaries of local associations could doubtless add greatly to the enjoyment of Mr. R. Greenwood's holiday by paying in their subscriptions promptly. The respected Treasurer of the Union cannot have a very easy mind just now.

***

Mr. Robinson, of Newcastle-on-Tyne, will publish, early in autumn, a choice collection of Bewick's wood engravings, executed between 1812 and 1828. Mr. Robinson will prefix an introduction containing much interesting and original matter, with notes and biographical sketches, and a catalogue of the principal Bewick works.

***

Mr. Hablot K. Browne, better known as 'Phiz,' under which name he designed the illustrations for Dickens's

'Pickwick Papers,' in 1835, died on the 8th July. He was born in 1815, and drew comic pictures at a very early age. He illustrated most of Dickens's works, besides making drawings for comic serials and well-known novels.

***

Messrs. W. H. Allen and Co. have just published, in two octavo volumes, an edition of the Plays and Poems of Charles Dickens.

***

Mr. A. C. Swinburne's new volume, 'Tristram of Lyonesse,' and other poems, has just been published by Messrs. Chatto and Windus. It contains some poems relating to child life, which all admirers of one of our greatest living poets will be glad to read.

***

Mr. Burton has bought the Velasquez portrait of Philip IV., at the Hamilton Sale, for the National Gallery, at a price of £6,300.

***

Messrs. W. Blackwood and Sons have recently published a very interesting work by Lt.-Col. B. D. W. Ramsay, entitled, 'Rough Recollections of Military Service and Society.' The book abounds in amusing anecdotes, not only of military life, but of literary notabilities and events, and is well worth reading. One anecdote of the late Earl of Beaconsfield is singularly good. It seems that Mr. Murray, of Albemarle Street, was accustomed to give a dinner to his literary friends every Christmas. The elder Disraeli and his family were always there, together with others. After dinner the young people used to have a round game together, but no one would play with Master Benjamin, *because he cheated so.* Perhaps it was not exactly cheating so much as cleverness, but the story shows that Lord Beaconsfield was as desirous of having the upper hand then as when he had become Prime Minister of England. It is only one more example of the truth of Wordsworth's famous saying, 'The child is father of the man.'

***

In the same book is a capital story of Wordsworth. Col. Ramsay was once travelling in a railway carriage with Wordsworth and his sister, together with a little girl who, soon after leaving some station or other, burst into tears. 'Both the old poet and his sister were much concerned, and began to question her as to the cause of her tears. It then appeared that the poor little thing ought to have got out at the last station, but had been asleep. Wordsworth and his sister, both actuated by the same kind intentions, put their heads out of the window, shouting, "Guard, guard! stop, stop!" I mildly pointed out to them that they were shouting to the wind alone, and that it was very dangerous, on which they subsided; but at the next station there was much talking to the guard on the departure of the little girl.'

***

Sir William Armstrong has given £5,000 towards completing two wings and corridors of the new Natural History Museum at Newcastle, and his wife has given £1,000 more to the general building fund.

***

Messrs. Griffith and Farran will publish immediately, under the title of 'Talks about Science,' a collection of popular lectures on Science by the late Thomas Dunman. Mr. Charles Welsh will contribute a prefatory memoir.

***

The second edition of Mr. Halliwell-Phillipps's 'Outlines of the Life of Shakspere' has just been issued by Messrs. Longmans.

Training Colleges.

GENERAL EXAMINATION, 1881.

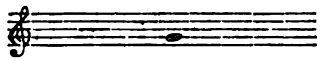
SECOND YEAR.

MALE AND FEMALE CANDIDATES.

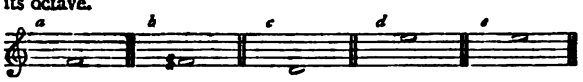
Music.

Two hours allowed for this paper.

The Tonic Sol-fa questions are printed in Italic. Candidates must keep *entirely* to one set of questions or the other. *You are not permitted to answer more than* NINE *questions.*

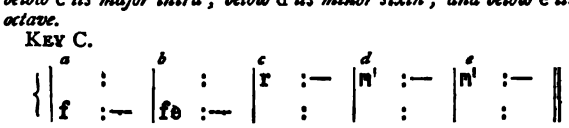
1. Of how many and what scales does this note form a constituent part?

1. *In how many and what keys does G* (Soh) *form a constituent part?*

2. Write above *a* its perfect fourth; above *b* its perfect fifth; below *c* its major third; below *d* its minor sixth; and below *e* its octave.



2. *Write above* a *its perfect fourth; above* b *its major third; below* c *its major third; below* d *its minor sixth; and below* e *its octave.*

KEY C.



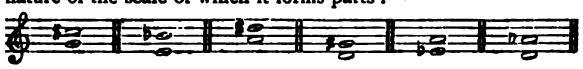
3. What intervals are classed as major and minor, and what as perfect and imperfect, and perfect and pluperfect?

3. *What intervals are classed as major and minor, and what as perfect and imperfect, and perfect and pluperfect?*

4. Is there any arrangement of a minor scale wherein an interval greater than a tone is employed?

4. *Is there any form of the minor scale wherein an interval greater than a tone is employed?*

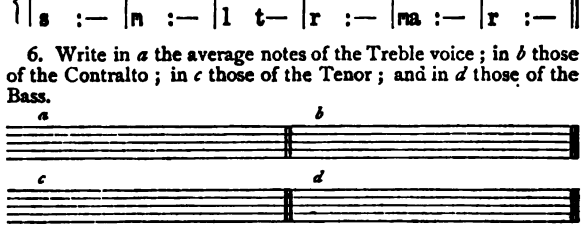
5. Write before each of the following pairs of notes the signature of the scale of which it forms parts:—



5. *Write over each of the following pairs of notes the name of the scale to which it would belong if not written chromatically:—*

de' :—	ta :—	re' :—	se :—	l :—	la :—
s :—	m :—	l t—	r :—	ma :—	r :—

6. Write in *a* the average notes of the Treble voice; in *b* those of the Contralto; in *c* those of the Tenor; and in *d* those of the Bass.

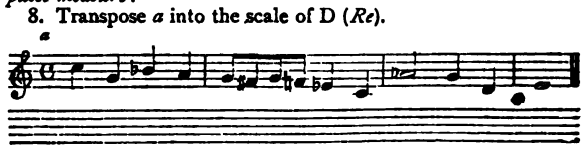


6. *Write the average compass of the Treble, Contralto, Tenor, and Bass voices.*

7. What are the strong beats in a measure of $\frac{3}{4}$ time?—in a measure of $\frac{6}{8}$ time?

7. *Where do the strong beats occur in three-pulse, and in six-pulse measure?*

8. Transpose *a* into the scale of D (*Re*).

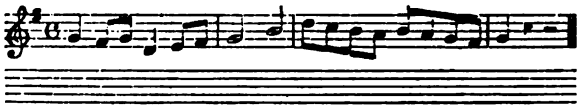


8. *Transpose the following into the key of D* (Re) :—

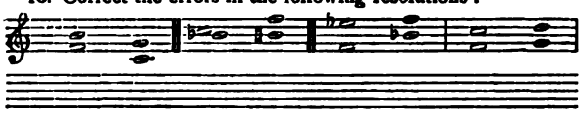
KEY B flat.

d' .s :ta .l	s,fe.s,f:ma .d	la .—:s .r	m .—:—.—

9. Write *a* in time of four quavers in a measure.

a

9. *Write a scale* (1) *in two-pulse measure*, (2) *in three-pulse measure, and* (3) *in four-pulse measure.*

10. Correct the errors in the following resolutions :—

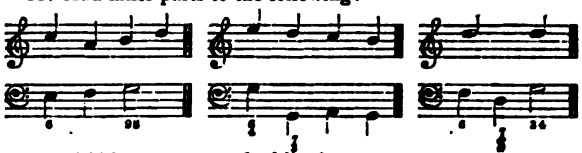


10. *Correct the errors in the following resolutions :—*

KEY C.

t :s	d' :f'	ma' :f'	d' :r'
f :d	ta :t'	f :ta	f :s

11. Add inner parts to the following :—

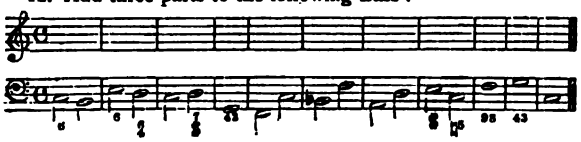


11. *Add inner parts to the following :—*

KEY C.

d' :l	t :r'	d' :r'	d :t	r' :—	— :—
:	:	:	:	:	:
:	:	:	:	:	:
m :f	s :—	s :s,	l, :s,	f :fe	s :—

12. Add three parts to the following Bass :—



12. *Analyse the following :—*

KEY C.

s	s :d'	t :-.r'	d' :f'	m' :-.m'	m' :r'	d'
	.r :m.fe	s .r:s .-	: .r'	t :t .d'	s :f	m
	: .r'	r' :s	.s :l.t,l	se :se.l	d' :t	d'
d	t, : .l,	s, :-.f	m :r	m :- .l	s :s,	d

SCOTLAND.

Special Paper for Graduates examined under Article 48 (a) of the Scotch Code.

SCHOOL MANAGEMENT.—No. 2.

Three hours allowed for this Paper.

Section I. and II. *must* be answered : not more than one question is to be worked in each of the other Sections.

SECTION I.

Copy the following passage clearly and legibly with correct punctuation and spelling :—

All his other labers were graddualy leeding up to this the crouning atcheevment of his life and cheif fondashun of his faim in relligious litteratur it is unicque vaste empossing and exaustive it rose beffore the eys of his contimprarys as a tempel of devine filossofy in which all knowlege natral and suppernattural found its plaice acording to one of his grate admirrers evry artical in it was mirraclouse as many artices so menny mirackles yet its principle excelance lys in its arangment and comprehensivness one serches it in vane for anything orriginel whither of conseptin methid or docktrin it is but a sistimattic welting togither and filing up of what lyes scattereed in the writter's preveous volumns hear evrything is bound toggither in an organnic hole with incomparrible lucciddety and proporrision it remminds one of nothing so much as of sum collosal forrest-tree rammyfying on evry side from the mascive collum of the trunc threw a maize of hudge lims and lesser branshes.

SECTION II.

(*a*) State what you know about the various systems adopted in elementary schools for teaching writing.

(*b*) Write in *large hand*, as a specimen of copy-setting, the words, 'Characteristics of immutability.'

(*c*) Write in *round hand*, as a specimen of copy-setting, the words, 'Elliptical exercises.'

(*d*) Write in *small hand*, as a specimen of copy-setting, the sentence :—

'The plumage of birds is periodically renewed.'

SECTION III.

What do you mean by 'Notes of Lessons?' What use ought to be made of them in teaching? Draw up full notes for an introductory lesson on *one* of the following :—

1. A class is beginning simple division : explain clearly each step in the process, and show how *division* is a short method of working *subtraction*.

2. Decimal fractions, explaining fully the rule for pointing (*a*) in multiplication (*b*) in division.

3. The present worth of £838, due 19 months hence, at 3 per cent., simple interest, is £800. Explain fully each step in the process of working the sum.

SECTION IV.

1. Explain clearly and simply, in the form of notes of a Lesson to an advanced class, the meaning of Principal, Rate per cent., Interest, Simple and Compound, Discount, and Brokerage. Illustrate your answer by suitable examples.

2. I sell £7,300 out of the 3 per Cents. at 96, and invest my money in 5 per cent. Bank Stock at £105 13s. 4d. Find the difference in my income.

Solve this question, explaining fully each step in the process.

3. Define a recurring decimal. How many kinds of them are there? What kind of vulgar fractions always give recurring decimals?

Multiply $\dot{7}575$ by $\dot{3}66$, and explain fully each step in the process.

SECTION V.

Draw up full notes for a Lesson to an upper class on *one* of the following :—

1. Magna Charta, the Solemn League and Covenant, the Habeas Corpus Act, and the Bill of Rights.

2. The state of the Highlands before and after the Rebellions of 1715 and 1745, and the cause of the change.

3. The influence of the French Revolution on the policy of Britain. The wars in which it involved this country, and the rise and extent of the National Debt.

SECTION VI.

1. A class of children, who know nothing of geography, is before you. Give full notes of your *first* lesson on this subject, and a scheme of your future course of instruction.

2. Describe, as you would to an advanced class, the position and extent of Australia, the different colonies into which it is subdivided, their relative situations, and the physical features, the climate and natural productions, of *one* of them.

3. State what you know about the Overland Route to India, the time occupied in effecting it, and the modern improvements to which it has given rise in Egypt. Arrange your answer in the form of a lesson to a pupil teacher.

SECTION VII.

1. (*a*) Describe, briefly, the means by which you would impart *the first elements* of grammar to children.

(*b*) At what stage in their progress should you commence this part of their instruction?

2. (*a*) In how many ways can you parse the words *that* and *what*, respectively? Make examples to illustrate your distinctions.

(*b*) Show, by examples, the *forms*, *use*, and *government* of participles in English.

3. (*a*) Explain, briefly, as if to a class, the distinction between 'simple,' 'compound,' and 'complex' sentences, and give an example of each.

(*b*) Make out a detailed analysis of the following passage:—

'Sweet Auburn! parent of the blissful hour,
Thy glades forlorn confess the tyrant's power.
Here, as I take my solitary rounds,
Amidst thy tangling walks and ruined grounds,
And, many a year elapsed, return to view
Where once the cottage stood, the hawthorn grew,
Remembrance wakes, with all her busy train,
Swells at my breast, and turns the past to pain.'

SECTION VIII.

The following passage having been prescribed as a reading lesson to your first class, what notes and illustrations would you consider necessary for your guidance?

'The year 1848 was characterised by political convulsions on the continent of Europe. On the 24th February a revolution commenced in France, by a general rising of the people against the sovereign, Louis Philippe. He fled from the storm which was gathering around him, and took refuge in England. The people declared France a Republic, and eagerly proceeded to demolish all traces of monarchical government, with singular forbearance, however, towards the lives of individuals. The shock spread throughout Prussia, Austria, Italy; and, indeed, in almost every state of Europe there was a momentary struggle for more constitutional government and popular freedom.

'A speedy reaction, however, rendered the monarchs of these states more absolute than ever. After some disturbances, not quelled without bloodshed, the French nation elected Louis Napoleon, nephew of Napoleon Bonaparte, President of their Republic, and tranquility generally prevailed. Again, on the 21st and 22nd of November, 1852, the President was elected Emperor, by nearly eight million votes, and took the title of "Napoleon III., Emperor of the French." After a reign of eighteen years, he declared war on Prussia, but, defeated in several battles, and worn out in mind and body by his reverses, he found himself at last compelled to give up his sword to the king of Prussia.'

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Publications Received.

Biography—

(1) Dicey's Victor Emmanuel. Marcus Ward and Co.

Chemistry—

(1) Volckxsom's Catechism of Modern Elementary Science. Kegan Paul, Trench and Co.

Domestic Economy—

(1) Greenup's Fifty Things to be Remembered in the Kitchen. Marcus Ward and Co.

Drawing—

(1) Imperial Drawing Books. T. Murby.

French—

(1) Jerrain's Miscellaneous Sentences for Translation into French. Longmans and Co.

Geography—

(1) Hughes's Elementary Class-book of Physical Geography. G. Philip and Son.

(2) Blackie's Geographical Readers, I. to III. Blackie and Son.

Grammar—

(1) Morrison's English Grammar. Gall and Inglis.

History—

(1) Comprehensive Historical Readers. Blackie and Son.
(2) Readings in English History. T. Murby.
(3) Scale of Nations. W. H. Guest.

Latin—

(1) Latin Course. W. and R. Chambers.

Mathematics—

(1) Mensuration for Beginners. T. Murby.
(2) Dodd's Inspector's Test Sums. T. Murby.

Miscellaneous—

(1) Digby's Hothouse Education. E. Stanford.
(2) Walter's Matriculation Classics. W. K. Lewis.
(3) Howitt's Visits to Remarkable Places. Longmans and Co.
(4) W. M. S. S. Union Annual Report. W. M. S. S. Union.
(5) Hulme's Art Inspection in England. Longmans and Co.

Music—

(1) Johnson's Day School Song Book. Bemrose and Son.

Periodical Literature—

(1) Universal Instructor, XXI. Ward, Lock and Co.
(2) Our Little Ones, IX. Griffith and Farran.

Prize Books—

(1) Gammon's Italy's Liberator. S. W. Partridge.

Science—

(1) Unwin's Elements of Machine Design. Longmans and Co.

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Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose name and address we will gladly give.

The Epoch of Reform, 1830-1850. By Justin McCarthy, M.P. London: Longmans and Co.

Mr. McCarthy gives us in his dates to understand fully what he means by the Reform Epoch. We have no desire to cavil at the enlargement of the most important peaceable revolution that was ever effected in our country; but the overwhelming interest and intense excitement that marked the Reform agitation from the memorable 1st of March, 1831, when the Bill was introduced, to the more memorable 7th of June, when it received the Royal assent, has not been equalled by the agitation of any subsequent measure. The struggle for free-trade was great and remarkable, but was comparatively smooth and placid to the rushing wave of the Reform excitement. Doubtless that victory paved the way for the great practical reforms that Mr. McCarthy describes with clearness and ability. The crying evil of slavery was first attacked by the reformed Parliament, and soon practically settled. Municipal reform followed, and the growing evil of pauperism was repressed, and the Poor Laws thoroughly amended. The greatest of practical modern measures—the abolition of the Corn Laws—followed, and though the contest was somewhat prolonged, the victory was thereby more thoroughly secured by the people being fairly instructed in the sound maxims originated by Adam Smith, and further expounded by Bentham. After the citadel of personal sovereignty, somewhat mingled with oligarchical power, was yielded by the Reform Act of 1832, the outworks that frowned upon popular power and defended class privileges were successively surrendered without serious resistance. All this is well told by Mr. McCarthy, and we know of no fairer or more trustworthy guide to the history of what Miss Martineau happily called the 'Thirty Years' Peace' than the compendium before us

A Compendium of Italian History. From the Fall of the Roman Empire to the Present Time. By J. D. Morell, LL.D. London: Longmans and Co.

The mass of this history is a translation and compilation from Bosco's *La Storia d'Italia*, which is pretty extensively used throughout Italy. Dr. Morell wisely omits the earlier portion of Bosco's book, which treats of the familiar topic of Roman history, and omits Bosco's chapters that defend the Papal temporal power, and prophesy all sorts of calamities should this not be restored. As also Bosco's pages terminate with the peace that Louis Napoleon hastily concluded with Austria at Villafranca, to the disgust and disappointment of Victor Emmanuel and the people of Italy, Dr. Morell supplements Bosco's narrative by his own, to complete the history of Italy down to the present date. In these supplementary chapters Dr. Morell has successfully imitated the style—suited to young readers—of the Italian priest Bosco, and altogether given us a trustworthy and lucid digest of Italian history. This is, however, hardly attainable by the mass of young students in the extensive and well got up volume before us, which is handsomely printed in imperial octavo, and illustrated with a few—we wish there were more—beautifully executed wood-engravings. A cheap edition of this book would be welcomed by many young students, who may read in the leading features connected with Italy of the great influences that have swayed modern Europe. The bewildering struggles between the Emperors of the East and the tribes of invaders from the North; the formation of a great empire by Charlemagne; the rise of the free towns and small Italian republics; the absorption of European commerce; the struggles for the possession of Italian territory by Spain, France, and Austria; and lastly, the unification of Italy under the house of Savoy, whose founders were Counts of a small territory—about the size of Kent or Sussex—on the western slopes of the Alps, all form threads that are intimately interwoven with the general history of Europe. Dr. Morell is a perfectly safe guide, and we wish he had given us a fuller description of modern Italian progress in education, and other matters developed by the consolidation of the power of Sardinia. The sketch of Italian art is remarkably good, though too brief, and the rise of modern music fairly traced to its Italian sources. One important fact, however, seems to have escaped the notice of most writers on this topic, except Mr. William Chappell, to whose popular music of the olden time we owe the knowledge that rhythmical music was mainly owing to the popular ballad sung to metrical lines, in contradistinction to the *ad libitum* style of recitative that marked other kinds of music.

Longmans' Modern Copy Books. Nos. 7, 8, 10. By. J. Tidmarsh. London: Longmans and Co.

We feel bound to award these three books (No. 7 Double Small Hand, No. 8 Double Small and Small Text, and No. 10 Small Hand) our highest praise. The letters are remarkably well formed, free from needless flourishes, and legible.

The clear, round writing in book 7 is sure to become a favourite with teachers.

Leedam's Exercises in Elementary Arithmetic. London: Philip and Son.

This systematic course of exercises in the first rules of arithmetic is adapted for use in preparatory schools and in private families, and as such has our hearty commendation. Not the least merit of the book is that it is printed in refreshingly large type.

The exercises, which are graduated, provide ample practice in the various rules. We commend the book to the notice of all engaged in private teaching.

Elementary Class-Book of Modern Geography. By William Hughes. Revised by J. Francon Williams. London: Philip and Son.

We have given unqualified praise to the 'Class Book of Modern Geography,' of which the book before us is an abridgment,* and have no hesitation in applying our remarks on the larger to this smaller book. The condensation has been skilfully and carefully done. The information is remarkably full, and, as far as we can see, unfailingly exact. We should have liked to have seen Greenwich included in the towns of Kent, Horsham in Sussex, Dorking and Reigate in Surrey, Bishopstoke in Hampshire, and the towns of Wimborne and Blandford, together with the now important watering-place Bournemouth, in Dorsetshire. But in this professedly condensed book we have little omitted that is important. The information is brought down to the present date, and includes the cession of the Transvaal to the Boers, and the present tentative condition in regard to the government of Zululand. It would be doing also injustice to this book to regard it as a mere compilation. There are judicious explanations given where most required. The preliminary definitions are also very good. The idea going before the word will please all practical teachers, as in the term '*Peninsula.*—A portion of land nearly surrounded by water is called a *Peninsula.*' Again: 'ISTHMUS.—A narrow neck of land which unites any two larger portions is called an *Isthmus.*' This is as it should be, and we may mention also that there are several explanatory definitions not usually met with in introductory class-books; as, for instance, 'COAST.—The line where the land and water meet is called the *Coast*,' and this is supplemented by further useful explanations of the terms *Shore*, *Beach*, etc. The book is altogether one of the best to be met with.

The Second Epistle to the Corinthians. With Explanatory Notes. By the Rev. Henry Linton, M.A. London: Philip and Son.

Mr. Linton is a painstaking and earnest writer. The authorities he adduces are of recognised eminence, and continually and specially referred to on points that occur. This is very different from the too-common practice of merely inserting the titles of books for reference, with the names of authors. After a general analysis a more detailed one is given for the benefit of younger students, and then follow notes to each chapter in succession. The notes, of course, constitute the substance of Mr. Linton's book, and are most worthy of commendation. Reference is made, when needful, to the original Greek for the literal rendering of some passages, and fuller understanding of the text. We could not wish to have a more earnest guide, or one with whom devout reverence and scholarly faithfulness are combined. We ought to add that this forms one of the series of Philips' Scripture Manuals.

Victor Emmanuel. By Edward Dicey, M.A. London: Marcus Ward and Co.

This volume forms one of the series entitled *The New Plutarch*, a title with which we do not complain on the ground of pretentiousness, but hope to see justified by the care exercised by the authors entrusted with its biographies. Some of the volumes published have already obtained a name, and we notice the names of writers of repute engaged in forthcoming works. The life of Victor Emmanuel is, as the author observes, 'the history of Italy from the period of her deepest decline to that of her resurrection as a living nation.' How that history is told in the book before us it behoves us to examine. With these thoughts we began Mr. Dicey's pages, and soon found ourselves in company with an author who was no

* PRACTICAL TEACHER, vol. i., p. 352.

blind enthusiast of remarkable success; in fact, the failings of Victor Emmanuel contributed in no small degree to the regeneration of Italy. The summary of the condition of Italy prior to its unification is able, spirited, and just. The contented submission of the Italians to the French sway and their hatred to that of Austria is well pointed out. After a biographical sketch of the House of Savoy, the primary cause of Italian hatred to the arrangements made at the suppression of the Neapolitan Constitution is tersely described. There was the latent force ever ready for development in the intense and enduring hate of the Italian for the accursed Tedeschi—or Teutonic ruler. It only needed the man to render this latent power active, and though Charles Albert failed, and in failing rendered the Italian cause apparently more hopeless, yet to all thoughtful men the overthrow of the Austrian rule was only a question of time, and as certain to come as rain from a heavily-charged cloud. The victory of Rudetzky at Custozza, after his masterly retreat behind the Quadrilateral, failed to show the Italians that Sardinia must be supported by something more than grandiloquent proclamations, mass demonstrations, cosmopolitan sympathies, and democratic decrees. Charles Albert, worthy of better days, was yet ready to 'try the last,' and did try the last at Novara, where, after a day's long battle, the hopes of Sardinia were crushed, and her king abdicated in favour of his son Victor Emmanuel, and the yearnings of Italy delayed—but only delayed. These introductory sketches occupy one-third of Mr. Dicey's pages. His description of Victor Emmanuel's difficulties and appreciation of his straightforward integrity is singularly clear and able. As the cause of Sardinia was lost by Charles Albert at Novara so it may be said to have been reconstituted by Victor Emmanuel's Moncalièri manifesto, which kept the Austrian bayonets aloof and paved the way for the future brilliant course of Cavour. Indeed, Victor Emmanuel united in himself bravery and prudence as perfectly as he did impetuosity and patience. 'Wait,' he said to the enthusiastic writer, Mapari, 'the day will come, but wait, and for the present I must work here.' Another strange compound in the king's character was his half-superstitious devotion to the church while forced to oppose papal measures. When giving his consent to Siccardi's bill for placing the clergy under the civil power, 'Remember,' said he to Siccardi, 'that you are responsible for this; and if this law send its authors to the devil you will have to go, not I.' On the question of civil marriages the king was even more unwilling to yield, till assured by his old tutor, Charvaz, Archbishop of Genoa, that he might fulfil his duty as a constitutional king without incurring the wrath of Heaven. With all this almost childlike simplicity of belief the king had a keen insight, not only into circumstances, but into character. When the name of Cavour was submitted to him for a subordinate official position, he smiled, and said to the other ministers, 'Your new colleague will soon be your master.' Not less skilful was his checkmating any repressive move of Austria by securing the support of Louis Napoleon. When Cavour came into the field of Sardinian politics the Austrians soon saw the hopelessness of intimidating or crushing Sardinia. The judicious move of joining in the Crimean war restored the reputation of the Sardinian army, and established a claim upon France and England for future assistance. Henceforth the masterly genius of Cavour guided not only both king and people to the goal of Italian unity, but with a force like that of gravitation, and as unseen, drew power after power to aid in the same grand object. The naïveté of the king's character was shown by his reply to the priests who were harassing him with fears for his condition after death while he was bowed down with grief for the loss of his mother, his wife, and his only brother. 'Well,' said the king, 'you see I have others to think about besides myself, and whatever may happen to me in another world I am bound as a sovereign first to secure the happiness of my people in this.' This was really the key-stone to his character. He was devoted to his people and to the unification of Italy. For this latter he worked patiently and unceasingly with perfect readiness to sacrifice himself if needful to attain the object. His sense of personal honour in regard to constitutionalism was unconquerable. When the relations between France and Sardinia became strained by the Orsini attempt, Louis Napoleon urged Victor Emmanuel to take prompt and effective measures to curtail the liberty of the press without the danger of failure and delay in appealing to Parliament. 'I cannot do this,' was the reply, 'as a constitutional king, and have pledged my word always to rule in this manner. Let what will happen, the House of Savoy have preferred the road of exile to the path of dishonour.' The French Emperor saw that it was wiser to let the matter drop with the semblance of a mild alteration in the laws of the press. The irritation of the French was equally directed against England. We replied to the threats of the French colonels by dismissing the popular Lord Palmerston for his supposed sympathy with Louis Napoleon, also by the acquittal of Dr. Bernard, which would probably not have happened but for the threatening attitude of France, and further by starting the volunteer movement.

Our limits will not allow us further to accompany Mr. Dicey through his well-written volume, which has much of the attractiveness of a romance by the dramatic character of the incidents, which led in ten or a dozen short years to the withdrawal of the strongest military power in Europe from the strongest positions of the fairest region of the earth; the willing adhesion of every state and province in the great peninsula to Sardinia; the departure of the French troops from Rome; the romantic career of Garibaldi; the danger of the unyielding Papal opposition; the difficulty of warding off the impossible yet persistent schemes of the republican party, guided by the great intellect of Mazzini; and the other marvellous moves of this the greatest game of political chess ever played by the great powers of Europe.

Science in a Nutshell. By Alexander Watt. W. and A. K. Johnston, Edinburgh and London.

Of Mr. Watt's pleasant writing on Scientific Industries, we have had before occasion to speak commendingly,* and this chatty little book will prove quite as acceptable to young readers, if not to grown-up ones, who desire a simple yet correct introduction to the elements of general science. By a series of experiments, mostly of a simple character and all practicable with ordinary care by amateurs, a considerable knowledge is gained of the leading features of Chemistry, Electricity, Optics, and Pneumatics. The process of Photography is clearly described, and its practice—of course on a simple scale—shown. The same may be said of Electrotyping, and the production on a small scale of the electric light. That the mathematical and demonstrative portions should follow these elementary steps no one will dispute, but we regard this kind of introduction by pleasing and lively experiments the best way to render science attractive, and induce young people to study it. We have been too apt to despise the old popular lectures which largely comprised such experiments as this little book clearly describes. We venture to say in opposition to Pope's maxim that a little science is better than none at all, and that the little, when so pleasingly brought before us by Mr. Watt, is the best prospect of the subject being followed up. Every experiment has its appropriate illustrative diagram. Young readers will, we believe, be charmed with the book.

The Scale of Nations. London: W. H. Guest.

This sheet presents at a glance a comprehensive view of the comparative sizes, areas, population, exports, etc., of the chief countries of the world. It is well arranged and clearly printed.

* PRACTICAL TEACHER, vol. i., p. 516.

Chambers' Graduated Readers. Books I. and II. London and Edinburgh: W. and R. Chambers.

A teacher must be hard to please who does not like this book, and as it is for little boys and girls they must be of the 'very naughty' kind who fail to learn from it. The lessons are well adapted to little beginners in regard to style, and are free from the drawback of affected simplicity. Short script sentences are appended to every lesson, together with words for the scholar to 'pronounce and write.' Further, little exercises are to be written that call up the thought of the little scholar, and the copying of sentences from the printed lesson. At the end are a few pages of cognate words arranged for spelling, together with the addition, subtraction, and multiplication tables. When we add that the book has on nearly every page an appropriate and well-engraved woodcut, its attractiveness to young readers will be admitted. Many of these engravings are really gems in their way. Of these we may mention 'The Bird in the Snow' (p. 66) and 'The Boat on the Lake' (p. 77). The semi-outline pictures are also not unfit for little drawing copies. We should prefer a better capital T to the script exercise on page 29; the one before us may be mistaken for an I or a J. One plain form for script characters is to be preferred.

Book II. does not appear to be so carefully edited in regard to uniformity of style. The well-known verses of the 'Spider and the Fly' are considerably in advance of such little lines as 'O tell me, gentle river,' and Mr. Howitt's ever-popular 'Voice of Spring.' In other respects this is as attractive as the First Book. In addition to the multiplication and pence tables, some capital explanatory little tables are given of the component parts of shillings, florins, etc.

Simple Interest, with Models, Hints for Working, Cautions and Numerous Examples. By Rev. H. F. W. Cowley, B A. London: Lewis, Gower Street.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

VII.

DISEASES OF THE SKIN.

THE *Squamous, or Scaly Diseases.* This class is made up of two or three very distinctive forms, which in their typical state are easily recognisable. They are not inconsistent with apparent good health. Children are frequently sent to school suffering under one of the forms belonging to this class, viz., Psoriasis; it is perfectly free from danger of infection. It affords a curious comment upon names, for we find that originally it was applied to the Eastern disease 'Leprosy,' and was synonymous with the term venomous, or malignant. It is now appropriated to a condition of skin which is only an increased secretion of scales. This arises from an inflammatory state of cutis; there is exudation nto, and thickening of, that structure. These actions are local, and are not attended with any evident constitutional disturbance. The surface of the skin is dry, there are neither vesicles, pustules, or any ulceration. The affection may exist in the form of simple spots, when it is called 'Psoriasis punctata,' each restricted to a single hair follicle. Sometimes these spots slowly increase in size, and each occupies an area the sixth to the third of an inch in diameter, when it is styled 'Psoriasis guttata.' These patches are sometimes almost white, and are frequently called Lepra, or the disease may occupy larger patches of skin from the first, it is then called 'Psoriasis circumscripta,' or 'diffusa.' Patches may become inflamed, and give rise to an exzematous rash, and it is even difficult for the expert to determine at first sight whether the disease belongs to the scaly or the vesicular class. As it subsides the scales fall off, and leave roundish red spots, which may be dull or copper coloured; at length they die away, and the skin is left without any mark or discolouration, to show the former position of the eruption. This may be somewhat changed by the excessive scratching to which the spots may be subjected by the patient.

Sometimes the disease affects the nails, they become brittle and split, or it is limited to the palms of the hands, and soles of the feet. These cases are probably connected with an hereditary blood depreciation, consequent upon Syphilis in a former generation. Sometimes the disease is excessively obstinate, the skin cracks and serous discharges ooze from it. It is then called 'Psoriasis inveterata.'

If children can be kept clean, there is nothing in these cases to prevent them from mixing with their fellows. It is a chronic disease, especially liable to relapse. It would be wrong to exclude the subjects of it from going to school on account of its nature. Probably half the cases which actually arise do occur in children. It is not uncommon, and it is well that managers should be able to recognise it, and act accordingly. Occupation, and regular habits by promoting good health, may help to cure it; whilst foul air, bad habits, and improper food, will tend to make it 'inveterate;' excess in eating and drinking fatigue or excitement of any unnatural kind, will render it more intractable. It requires medical treatment for its cure, which will be generally found in the internal administration of minute doses of arsenic or iodide of iron, and the local application of some of the creosote, or tar preparations which are now frequently to be met with. The diet should be simple: Salt meats, pork, spices, and stimulants should be altogether prohibited. Coffee, by drying the skin, is also injurious. Fresh fruits, vegetables, and milk foods, are more advantageous than meat. If there is a syphilitic taint, it will continue to teaze the constitution until some other and more serious malady takes its place.

Pityriasis is another scaly disease. The name is derived from a Greek word signifying bran, and a branny kind of scale is its distinctive feature. It is requisite to avoid mistake, and not to confound it with the desquamation, which arises after measles or scarlatina. It would be difficult for the non-medical mind to distinguish the one from the other, if it were not for the general illness which had preceded the one, but not the other. It is sometimes mistaken, and much unnecessary alarm excited when the skin disease is thought to be the sign of the eruptive complaint. Another mistake is often made regarding the form which is known as 'Dandriff,' 'Pityriasis capitis.' This is due to an excessive secretion from the sebaceous glands in the scalp, and may be mistaken for infectious disease, whilst it is really harmless; but it is indicative

of a want of cleanliness, and the collection of scales in the hair may be a nidus for infectious disease, if such children come in contact with the germ which produces ringworn or favus. A form of chronic erythema is sometimes called Pityriasis improperly; it is seen at the corners of the mouth, on the lips and cheeks of delicate children. It may be induced by the use of soaps which are too alkaline, or by any means which will take off the epidermis in too rapid a manner, by which the tender cuticle is too much exposed. 'Pityriasis simplex' occurs in the form of small white round patches in the hairy parts of the body, which become covered with branny scales, and may give rise to patches of baldness. The baldness will not arise if the patch is cured quickly. This may be rapidly effected by using a solution of borax in rose water (one dram of salt to the ounce), and afterwards applying a solution of bichloride of mercury, such as was prescribed for the cure of Acne.

Frequent bathing in soft water, and an unction with pure salad oil, will help to get rid of the tendency.

There is a form of disease called 'Pityriasis versicolor,' which is due to a parasite, and which can only be cured by destroying the fungus which produces it.

Ichthyosis, or the *Fish skin disease*, need only be mentioned. It is sometimes seen in a very slight form, in which the skin is mapped out in a quadrangular or irregular-shaped segments, covered with slabs of cuticle, adherent in the centre but loose at the sides. Sometimes the whole body seems covered with laminæ of cuticle loosely adherent to the cutis; it is smooth and shining. It is not of such a character as need excite the attention of the master, except to see to the scrupulous cleanliness of the child, and that the diet be always wholesome.

The *Vesicles* consists of several forms of malady under the names (1) Sudamina, (2) Miliaria, (3) Eczema, (4) Herpes or Tetter, and a class which go by the name of (5) Blebs, or Pemphigus and Rupia.

Varicella and Vaccina are sometimes called Vesicular, but it is more convenient to class them with the Exanthemata.

'Sudamina' are simple transparent vesicles, which are often met with upon the bodies of rickety or tubercular children, who sweat much. They are hemispherical and smooth. They are not uncommon in the course of continued and other fevers. Miliaria are similar; they are not hemispherical, but acuminated and surrounded by a zone of redness. They are met with in cases of fever, and only call for mention.

Eczema is one of the commonest of skin diseases. It arises in the form of minute vesicles, containing serum. The fluid evaporates or absorbs, and their flakes or crusts are left. There is an erythematous condition, with heat and tingling. The skin is red and raw looking. As soon as the flakes are removed, or even before the removal, there is a fresh crop of vesicles. The parts burn, or tingle and itch most abominably. It is closely allied to the papular and scaly forms of disease, and, when inveterate, renders life a positive burthen to the sufferer. It may be set up by the use of irritant applications in constitutions prone to it. It often accompanies scabies, that is the disease which the itch insect produces. I have often seen it rendered extremely difficult to cure by the action of the little microscopic red insect called the harvest bug, which frequents the thickets and hedgerows on the chalk hills of Surrey. It burrows into the legs and arms of boys who hunt them for birds' eggs and blackberries, and if the cause is not recognised cure will not follow upon the treatment adopted. The distinctive characteristic of Eczema is the fibrinous exudation which stiffens and stains the linen garments of the wearer. The discharge, which comes from a simple chafe caused by friction ('Erythema intertrigo' is its scientific name), is not abundant, and does not stiffen the linen, so need not be mistaken for that disease. Eczema is common in children, and when it affects the head is called 'Eczema capitis.' The discharge is yellow, from mixture with sebaceous secretion. There is excessive production of epidermis; the fluid becomes purulent, and the hair mats together, forming a disgusting mass. This form differs from the infectious form called 'Tinea Tonsurans,' or Favus, inasmuch as that the hairs are intact, not broken off, twisted, and sheathed with a fine white deposit, as is the case in favus. There is also no moist discharge. The disease sometimes affects the ears, especially the grove behind the pinna. It sometimes affects the hands in those who handle sugar, soda, dyes, and other irrirating merchandise. 'Grocers' itch,' 'washerwoman's itch,' and 'bakers' itch' are all varieties of Eczema.

The treatment of this form of complaint is mixed up with constitutional remedies, and cannot be got rid of by local measures. Diet should be moderate, stimulants altogether avoided, and the immediate exciting cause be removed. The tendencies of the child must be considered as to whether there is any syphilitic, rheumatic, gouty, or scrofulous tendency, or whether it has had its origin in outside causes. The local crust should be removed by bread-and-water poultices, the hair must be cut to expedite the removal of the crusts, and the part affected kept scrupulously clean. A more decided course of treatment must be prescribed by the medical attendant, which will be according to the tendencies above referred to, for each requires a different class of medicine.

Herpes or *Tetter*, as it is commonly called, is a non-contagious and vesicular disease taking on several forms. The most common is 'Herpes liabialis,' a breaking out in the lips, which indicates cold, and may disappear after a few days; or it may be the accompaniment of a much more serious complaint, and is often one of the signs of inflammation of the lungs. It begins by redness and heat in a small patch. The vesicles scab over in two or three days, and if left alone fall off without leaving any permanent scar. When they form in the throat they give rise to considerable constitutional disturbance.

'HERPES ZOSTER,' or shingles, is another form of the disease. This form is limited to one side of the body. It is occasionally preceded by very great pain, and has been mistaken for Pleurisy, as its usual seat is on the ribs, although it may appear on any part of the body. The crop of vesicles is connected with some nerve disturbance, the nature of which is not yet fully understood. It commences with a hard inflamed base; the vesicle contains clear fluid at first. This changes in a few days to opaque lymph, which dries up and leaves a black scab. It is attended with a burning, pricking heat, and itches a great deal as it dies away. Old people often have a deal of neuralgic pain in the seat of the eruption, which may continue after all sign of the eruption has ceased, but this is quite unusual in children. Local treatment is best let alone. The vesicles should be covered up with

cotton wadding, so as to avoid friction, and not interfered with; whilst if the appetite is indifferent and the tongue foul, a little senna tea, followed by a dose or two of Gregory's powder, will be all the treatment that will be required. If the scabs are inclined to cause any breach of surface, they may be dressed with zinc ointment night and morning until they are entirely separated, and the surface of the skin has healed. 'Herpes cicinatus,' or Iris, is a form improperly named Herpes, and in which the disease is caused by a parasite. It is infectious.

The *Bullæ* or *Blebs* are serious forms of disease, which are not likely to be met with in children at school. They are connected with a blood disease, and always require skilful medical treatment to effect a cure. In Pemphigus there are large blebs filled with an albuminous alkaline fluid, with an ulcerated under surface. In Rupia the bleb dries up and forms a crust, which becomes thicker as it rises above the level of the skin, and when it drops off leaves a deep ulcer in the skin, which heals after a time, leaving a distinct and specific mark behind it.

The *Pustules.* The last class to be considered are the Pustules, excluding Farcy and Small Pox. They are limited to two forms, 'Ecthyma' and 'Impetigo.' They are not common diseases. The former are round isolated pustules, with hard inflamed bases, which form brown adherent scabs, and when they drop off they leave a violet stain in the skin, but this fades away in time. Tartar Emetic ointment is sometimes used to bring out an eruption of this kind for purposes of counter irritation. The disease may be either acute or chronic. The latter assimilates very much to a crop of boils, but runs a slower course, is more painful, and has a core which does not form in a case of Ecthyma.

'*Impetigo*' is more common; it may be caused by local irritation, such as Pediculi in the heads of children, or by improper food or a poor kind of diet. The pustules occur in groups, which come to maturity in forty-eight hours, and rapidly discharge a thick purulent matter, giving rise to a brownish-yellow irregular-shaped crust. These crusts are slow in separating, and are sometimes mistaken for a more infectious form. The character of the pustule in Impetigo Capitis should at once distinguish it from Tinea or Favus. When it attacks the face of children it is called 'Crusta lactea.' Impetigo is sometimes contagious, and seems to spread from child to child, so that care is required to distinguish it. It seems as if the secretion in the heads of some children render them excessively prone to grow crops of pediculi. The ova of these parasites, popularly known as 'nits,' will be seen attached to the hair. They may be detached by washing the hair with vinegar and water, and then dressing the roots with white precipitate ointment or decoction of staves acre. This latter is the basis of the Persian insect powder, which is used for the same purpose. The presence of nits either favours the production of Impetigo, or the latter encourages the breed of the former, as they are very often in company. Cleanliness and the use of sulphur ointment occasionally if the presence of the nit is suspected will be the best plan to adopt.

From preceding observations it will be understood that diseases of the skin arise from several causes: they may be constitutional and inherited; they may arise from infection or local irritation. Each cause requires a different kind of treatment, but all require the most scrupulous cleanliness and attention to diet. It is requisite to distinguish the constitutional tendency, because it is of more consequence than the name of the skin disease. First determine the point as to its contagious or non-contagious character, then the constitutional tendency, and thirdly, attend to the diet of the child. This should be vegetable, fruits, fish, and milk foods, whilst stimulants, meats, and indigestible things should be studiously avoided.

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

No. XIX.—THE BEAR TRIBE.

Part II.

THE animals belonging to the curious group of Sun-bears derive their name from their habit of basking in the rays of the hottest sunshine, instead of retiring to their dens during the heat of the day, after the manner of bears in general. The generic title of *Helarctos* refers to this habit, being a compound of two Greek words, the one signifying the sun and the other a bear.

As a representative of the genus, several species of which are known to exist, we will take the Malayan Sun-bear, or Bruang (*Helarctos Malayanus*), a native, as its name implies, of certain parts of the Malay Archipelago.

This is by no means a large animal, seldom measuring more than four feet six inches in length when fully adult. The muscular powers, however, are very great, far more so than might be imagined when the small size of the bear is taken into consideration.

The lip and tongue are very flexible, and the latter organ is capable of considerable elongation. It is thought that this structure is intended to assist the animal in robbing the nests of the wild bee, by inserting its long and lithe tongue into the apertures, and licking out the contained treasures.

The colour of the fur is a deep, glossy black, with the exception of a crescent-shaped white mark upon the breast and a yellowish-white patch upon the snout and upper jaw. The hair is rather short, but is of a very fine and delicate quality, which renders the skin of some little value as an article of commerce.

The bruang seems to be almost exclusively a vegetable feeder, giving the preference to fruit of various kinds, and more especially to the young shoots of the cocoa-nut palm. So fond is the animal of this latter diet that in some parts of Sumatra, where the villages have been deserted hy their human inhabitants, the cocoa-nut plantations have been completely destroyed by his constant degradations.

Being a singularly even-tempered animal, the bruang is easily tamed, and speedily adapts himself to the conditions of his new mode of life. One of these bears, which was in the possession of Sir Stamford Raffles, was of so quiet and peaceable a disposition that he was

even allowed to remain unchained in the nursery tenanted by his master's children, and was also allowed to sit at table together with the family.

Here he became so fastidious in his diet that he would refuse any fruit except mangosteens, and any wine except champagne, for which beverage he developed a great fondness. His master used to say that he never knew his pet to lose his temper except when his favourite liquid was withheld.

Included in the same group of the ursine family, although not belonging to the same genus as the bruang, the Aswail, or Sloth Bear (*Melursus Lybius*), next claims our attention. This strange-looking creature is a native of the mountainous parts of India, where it is an object of great admiration, mingled with considerable dread, to the native population. It is by no means a fierce animal, however, and even if attacked and slightly wounded will, as a rule, seek safety in flight rather than attempt to revenge itself upon its pursuer. But if driven to bay, or enraged by a severe wound, it becomes a very dangerous enemy, and will fight with furious energy until it either destroys its foe, or is itself slain.

The peculiar aspect of the aswail is chiefly owing to the length of the hair, which falls in thick clusters over almost the entire body. The colour is a jetty black, with the exception of a forked patch of whitish hairs upon the breast.

The aswail is not in the habit of basking in the sunshine, like the animal about which we have just been reading, but retires to its den during the greater part of the day. This habit is probably owing to the structure of the feet, the soles of which are remarkably tender. So much is this the case, indeed, that in several instances, when the bear has been driven from its hiding-place, and pursued by hunters during the heat of the day, the soles of the feet have been found to be terribly scorched and blistered with the heated stones and rocks over which the animal has passed.

Owing partly to the nocturnal habits of the aswail, and partly to the dread with which it is regarded by the natives of the country it inhabits, we know comparatively little of its mode of life when in a state of freedom. It seems to exist upon an almost purely vegetable diet, varied only, except upon very rare occasions, by such small creatures as slugs, ants, bees and their honey, and so on.

THE last of the true bears which can be described in these pages is the well-known Polar Bear (*Thalarctos maritimus*), the Nennook of the Esquimaux.

All the bears are good swimmers, and are able to cross rivers, etc., with perfect ease, should occasion arise for so doing. The nennook, however, far surpasses its congeners in the matter of aquatic locomotion, being able to pursue and capture the very fish themselves in their native element, and almost to rival the seals in the ease and agility of their movements.

Being intended by nature to lead in great measure an aquatic existence, we may expect to find that in the polar bear some points of structure are modified to suit the requirements of its mode of life. And such is indeed the case, for the form of the body is such as to enable the animal to cleave through the water without any great exertion, while the huge and hair-clad paws afford excellent paddles for the supply of the necessary propelling power. Then, the senses, more especially that of scent, are exceptionally keen, as is proved by the fact that the animal will discover, by the exercise of its olfactory powers alone, the tiny breathing-holes which the seals have made through the ice, even though those breathing-holes are covered with a thick layer of snow.

In the capture of its prey, which chiefly consists of seals and fish, the polar bear is remarkably adroit, having been repeatedly seen to dive into the water after a salmon, and re-appear almost immediately with the captured fish in its mouth. With regard to the seals, however, which are fully its equals in the natatory art, and possess, moreover, the power of remaining below the surface of the water for a considerable period of time, the bear adopts very different tactics.

Let us suppose that it has caught sight of a seal resting near the edge of a floating piece of ice at some little distance. Plunging noiselessly into the water, the bear at once dives, and proceeds as far as possible in the required direction before seeking a fresh supply of air. When this becomes necessary, the animal merely pokes its nostrils above the water for a few seconds, without exposing to view any other part of its body. As soon as the act of respiration is completed, it again dives, and so on until it has passed over the distance which separated it from the object of its attack. The last dive is always timed so that the bear makes its appearance within a few feet of its anticipated victim, which has now no chance of escape. If it attempts to take to the water it is immediately seized by its expectant enemy, while if it should take to flight across the ice it is quickly overtaken by the more active bear.

The nennook owes its peculiar activity upon the frozen surface to the thick hair with which the soles of the feet are covered, and which enable it to pass along almost as readily as upon dry land. It also serves a second and equally important purpose, protecting the foot from the extreme cold of the substance with which it is so constantly in contact.

The size of the paws is wonderfully large, their length being fully one-sixth of the entire length of the body. The claws with which they are armed are not as long as in some of the preceding animals of the group, and are but slightly curved. Nevertheless, they form very terrible weapons, by the aid of which the bear can slay the huge walrus itself, beating in its skull by repeated blows of its mighty paw, as was mentioned in a prior article of this series.

The head is rather small when compared with the size of the body, and this circumstance, together with the length of the neck, gives a very snake-like appearance to the fore-parts of the animal's person. The fur is of a silvery-white hue, tinged with cream-colour, which varies in intensity in different individuals. The claws are black, forming a great contrast to the whiteness of the fur.

For many years great uncertainty prevailed as to whether the polar bear passed the winter months, or any part of them, in a state of hibernation, some observers telling us that the animal invariably retired to some sheltered retreat during the winter, while others asserted that nennooks might be seen at large throughout the whole of the year. Neither of these reports was altogether correct, nor yet entirely wrong, for it has lately been ascertained that the female bear alone hibernates, while the male continues to roam about in search of prey just as at any other season.

Neither does the female hibernate unless she is

about to become a mother, in which case she selects some sheltered spot for her habitation, generally choosing the cleft of a rock, or some such situation, where she may be, at all events, partially protected from the inclemencies of the weather. Before she has been a tenant of her new home for very long she is completely covered by the snow-drifts, being thus effectually screened from the observation of enemies.

The young of the polar bear are generally two in number, and are born about two months before their mother makes her reappearance in the world. By the time that this event takes place they attain to a considerable size, being then about as large as an ordinary shepherd's dog.

Although to a great extent aquatic in its habits, the polar bear is often found at a considerable distance from the sea-coast, specimens having sometimes been met with more than thirty miles inland. These excursions are generally brought about by hunger, either from the failure of the food-supply, or, as frequently happens, from the fact that the bear has been carried to a considerable distance from its usual haunts by the separation from the main body of the piece of ice upon which it is resting. Sometimes quite a small colony of bears are carried off in this manner, causing terrible havoc amongst the herds of the country in which they may happen to land.

Besides being endowed with great strength, the nennook is also possessed of considerable powers of endurance, as may be imagined from the fact that upon one occasion one of these bears was seen steadily swimming across a channel more than forty miles in width. Indeed, as far as the natatory art is concerned, it is but little inferior to the seal, and its proficiency in this respect, together with its great muscular power, and the terrible weapons with which it is provided by nature, renders it the acknowledged monarch of the polar seas.

Even the enormous and powerful walrus falls a victim to the polar bear, and the strength of the bear can be best appreciated by comparing it with the animal which it kills. A fine male walrus measures some fifteen feet in length, so that if it had legs fit for walking, it would surpass in size the generality of elephants.

In order to understand the real size of the walrus, let the reader measure a line of fifteen feet in length upon the wall of a room, then let him sketch in imagination the form of the animal as shown in any illustration, and he will see what an enormous creature it is. We will here briefly recapitulate the method by which the bear can destroy a prey so much larger and stronger than itself.

Like the rest of the seal tribe, the walrus is in the habit of leaving the water and sleeping on shore or on the ice. When the polar bear attacks a walrus, it always chooses the one that is farthest from the sea. Creeping silently behind the sleeping animal, the bear leaps on its back, holds on with its hind feet and one of the fore-paws, while with the other it delivers a series of rapid blows on the head.

The startled animal at once makes for the sea, but unless it be an old one, it generally succumbs before reaching the water, the skull being battered in as if with blows of a sledge-hammer. In the old walrus, however, the skull is so thick and strong that it can resist even the white bear's paw. The bear bangs away as long as they are ashore, but if the walrus can once reach the water, it is safe. The water prevents the bear from delivering its terrible blows, and as the bear knows instinctively that the walrus can remain under water for a very long time, it relinquishes its prey.

Many an old walrus is killed which has its head, neck, and shoulders all seamed and scarred by the talons of the bear.

The thick fur of this bear, like that of the seal and the feathers of the duck, repels the water, so that the skin remains perfectly dry. The fur, however, must be in good condition, or it loses this protective power.

Some years ago a young polar bear was forwarded to the Zoological Gardens. It naturally made for the water, and soon was noticed to be floundering about in a very awkward manner, until at last it sank. The water was at once drawn off, and the animal rescued. Then it was found that, during the long journey, the fur had become clogged with dust, so that the hairs could not 'set' properly, and admitted the water between them. Consequently, the poor creature was actually being drowned by the weight of its own fur.

WE must now bid farewell to the Bears, properly so called, and turn our attention to some of the other members of the ursine group.

The most familiar of these is the well-known Racoon, or Mapach (*Procyon Lotor*), which presents in its general appearance a well-marked resemblance to some of the preceding animals.

The gait of this animal is rather peculiar. A plantigrade, like all the members of the ursine group, it is so only when standing, sitting, or slowly moving, proceeding after the fashion of the digitigrades when hurried or otherwise excited.

The fur of the racoon is of two qualities, a coat of soft, warm hair lying next the skin, while a number of long bristle-like hairs form a kind of thatch to the whole. The markings of the body are of a rather complicated nature, and are by no means easy to describe with any degree of exactness.

The woolly fur lying next the skin is of an uniform grey colour, while the longer hairs which project through it are marked alternately with black and greyish-white. Upon the knee-joints, the top of the head, and across the eyes, the fur is very much darker than upon the rest of the body, approaching, indeed, very closely to black in its depth of hue. The tail is of a dark-grey colour, marked with several bands of brownish-black.

Like all the preceding animals of the group, the racoon subsists upon a diet consisting of both animal and vegetable substances, seeming, as a general rule, to prefer the latter. It is very partial, however, to crabs, oysters, and other animals of a similar character, contriving to secure and despatch the former without affording them an opportunity of retaliation. As regards the latter creatures, however, it is not always equally successful, and many stories are told of racoons which have been so firmly held by the oysters which they were endeavouring to open that they have been unable to release themselves from their painful bondage, and have accordingly perished by the advancing tide.

The racoon is a very thirsty animal, and, besides drinking great quantities of water, has a peculiar habit of moistening its food, wherever practicable, before proceeding to devour it. This it does by grasping the food in the fore-paws, and shaking it rapidly backwards and forwards in the water until it has absorbed a sufficient quantity of liquid. Owing to this curious practice, the animal has received the specific title of *lotor*, *i.e.*, 'a washer.'

The racoon is nocturnal in its habits, and, being a very active and agile animal, is held in great favour by the colonists as an object of pursuit. It is usually hunted by means of dogs, which chase it until it seeks safety in the branches of some tree. A fire is then lighted beneath its refuge, in order to afford sufficient light for one of the hunters to ascend the tree and dislodge the animal from its perch.

In spite of the comparatively small dimensions of their quality, a full-grown racoon only equalling a small fox in size, the dogs do not always meet with an easy task when despatching their victim. Once fairly driven to bay, the hunted animal flies at its pursuers with the greatest fury, and seldom succumbs without having severely wounded one at least of its foes.

RESEMBLING the racoons in many respects, the curious animals known as Coaitis may be at once known by the prolongation of the muzzle, which forms a mobile snout of great service to the animal when rooting in the ground in search of the worms, etc., which form a great proportion of its diet. When drinking, the snout is turned upwards, in order to keep it as much as possible out of the water.

All the coaitis are natives of South America, being generally found in small clusters amongst the branches of trees. One of them, the Coaiti-mondi, or Red Coaiti *Nasua rufa*), is so named from the colour of its fur, which is of a bright chestnut hue upon the greater part of the body, with the exception of the ears and legs, which are black, and the tail, which is marked with maroon-coloured bands. A patch of whitish hairs is found upon the jaws.

This animal is wonderfully active amongst the tree branches, galloping from bough to bough with an agility little, if at all, inferior to that of the squirrel itself. It invariably descends the trunks with its head towards the ground, trusting for its foothold chiefly to the claws of the hinder feet, which can be inserted into the smallest crevices of the bark. Like almost all the ursine animals, it is nocturnal in its habits, passing the hours of daylight in some sequestered nook where it is tolerably secure from the attacks of its foes.

Want of space precludes us from describing the other species of coaiti known to science, and we must therefore pass to the remarkable animal known as the Kinkajou, or Potto (*Cercoleptes candivolvulus*).

This is one of those anomalous creatures of which one at least is to be found in almost every family of animals, and considerable uncertainty still prevails as to whether it is rightly placed in its present position. In its general appearance, and in its habits, it bears a very strong resemblance to the lemurs, with which animals it was at one time ranked. The structure of the teeth, however, caused it to be separated from that group, and assigned a position amongst the *carnivora*, under the title of the Mexican Weasel. Again, however, the structure of the teeth was taken into consideration, the surface of those in the lower jaw being adapted for grinding vegetable substances, and the fact, together with the prehensile nature of the tail, caused it to be situated, at any rate for the present, at the end of the ursine group.

The kinkajou is an inhabitant of Southern America, where it is spread over a very large extent of country. Its existence is chiefly arboreal, its long claws and prehensile tail being of great assistance in its evolutions amongst the branches.

The tongue is endowed with singular flexibility, and can be lengthened to a wonderful extent. By its aid the animal is enabled to rob the nests of the wild bee, inserting the tongue into the orifices, and licking the honey from the waxen cells. Insects, small birds,

eggs, fruits, etc., constitute the remainder of its diet.

The kinkajou is not a very large animal, about equalling in size an ordinary cat. It is easily tamed, and is a very pretty, affectionate pet. Some years ago I made acquaintance with a kinkajou in the Zoological Gardens. The animal was always delighted to see me, and when the keeper opened the cage the kinkajou would clamber to my shoulder, and sit there quite happy, with its long, soft tail coiled round my neck.

(To be continued.)

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Eminent Practical Teachers.

DAVID STOW,

*Founder of the Training System of Education.**

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

THE personal history of an eminent philanthropist must ever prove interesting and attractive, especially if the incidents of his life have determined the character of any great scheme with which his name has become inseparably associated. It is, unfortunately, beyond our power fully to determine the effects of circumstances on the life-work of David Stow; but, though the desired details are not at our command, it may still be possible to explain to some extent, and in connection with a brief biography, the historical development of the Moral Training System of Education of which he is the distinguished author.

David Stow was born on 17th May, 1793, at Paisley, to which town his father, Mr. William Stow, had removed from Durham to engage in business as a merchant. His mother's maiden name was Agnes Smith, a Christian lady, remarkable for the 'devotedness with which she trained her children in the fear of the Lord.'

Alexander Wilson, the ornithologist, John Wilson, the author of the celebrated 'Noctes Ambrosianæ,' etc., James Wilson, the entomologist, Robert Tannahill, the poet, John Henning, the sculptor, and other men of note, were fellow-townsmen, and near contemporaries of David Stow; and in the early part of the present century Paisley had a renown for the pursuit of natural science, literature, and art, which it still retains, though the transformed town is no longer, as Rowland Hill described it, 'the Paradise of Scotland.'

Mr. William Stow for many years held the office of magistrate. His son David received at the Paisley Grammar School the ordinary English and classical education given to pupils of his rank, and it is said that in all his classes he gained 'an honourable place.' The character of the instruction given at that time was, however, little calculated to develope the intelligence. School work chiefly consisted in taxing the memory, in many cases most unprofitably, as the acquired words and phrases were never explained, and the principles embodied in oft-repeated rules were rarely illustrated or applied. 'The religious instruction was little more than the reading of the Bible, which teachers managed to make the most distasteful of text-books.' Any true pleasure obtainable under such a system of instruction was necessarily reserved for those few pupils who were far enough advanced to master and appreciate the higher classics. Such mechanical methods,—*mere* memory work,—almost universally prevalent at the beginning of this century, may perhaps still linger in a few schools, but the presence of an intelligent teacher, to give life to the 'letter' and cultivate simultaneously all the mental powers, is now, happily, a generally admitted necessity.

Young David gained all the advantages which the Paisley Grammar School was able to afford. His mild disposition usually led him to avoid the more boisterous sports of the playground, though he was physically equal to the roughest games of his companions. The 'fair-haired youth' was remarkable for vivacity and buoyancy, but preferred, nevertheless, to associate with the 'gentler few' of his playfellows. His delight was 'to *observe* the amusements of his companions and witness their happiness;' and he began early to evince those powers of rapid observation and almost intuitional inference by which he was in after life distinguished.

The influence of school life on the formation of character no parent can afford to disregard. Still, the chief formative forces should be found in the family circle. A parent possesses a power which it is impossible to delegate to another. That power involves privilege as well as responsibility. 'Train up a child in the way he should go' was a command to which is attached a promise which was implicitly believed by David's parents—'when he is old he shall not depart from it.' The habits of their household were regulated by Christian principles. 'The duties of the magistrate's office, the pressure of business, and the claims of social life, were rarely permitted to interfere with regular religious exercises, and the special study of the Scriptures in a weekly meeting of earnest men, held in the father's house, impressed the observant children's minds;' whilst the 'fervent prayers and patriarchal gravity persuaded them of the reality of religion, and the memory of these hallowed assemblies lingered long amid the vicissitudes of after years.' Mrs. Stow's piety, though unobtrusive, was impressive and controlling. 'The mother's influence was with young David, as it has been in countless instances, a privilege of unspeakable value.' The whole family felt those subtle and silent forces which most tell on the opening history of childhood and youth. Among the most welcome of the visitors was the Rev. Dr. Love, whose life—'a living epistle'—the young observer studied with profit, gaining thence strength and courage, whilst as yet he was unable to understand the doctrinal discourses on the Sabbath-day. The hallowing influences of home constituted the most valuable part of David Stow's training, and prepared him for his future work.

At the age of eighteen Mr. Stow entered the service of a Glasgow firm, and the circumstances of his new position were such as to test the strength of the principles which he had learnt beneath the parental roof. By an early and wise choice of congenial companions his moral courage was strengthened, and he not only

* The writer of this article is largely indebted to the work of his friend the late Dr. William Fraser, of Paisley, entitled 'Memoir of the Life of David Stow,' which was published in 1868, by Mr. James Nisbet, Berners Street.

remained steadfast and unmoveable amidst the subtle and syren influences by which he was surrounded, but became also the centre of a Society which, as he then wrote, should form 'an asylum for those who were struggling between a father's advice and those with whom chance may have led them to associate.' He was among the foremost to support missionary enterprise in heathen lands at a time when it was unpopular. The needs of 'the neglected' in his own city, however, stirred his utmost sympathy, and nerved him to resolute effort for their relief. Within twenty years Glasgow had doubled its population, and the immigrant 'families were huddled in masses together in miserably unsuitable homes,' sinking, morally, from bad to worse. His daily duty led him through the Saltmarket—the St. Giles of Glasgow—and in the presence of 'shameless profanity, indecency, and filth,' the question pressed with growing urgency upon his mind and heart, 'Can nothing be done to stem this deepening torrent of degradation and vice?'

Mr. Stow's experience as almoner of funds for the relief of the poor, convinced him of 'the comparative hopelessness of every effort to reclaim the old.' 'An amount of deceit, ignorance, and wickedness was gradually revealed, which convinced me that the favourite idea of reclaiming the old was a hopeless one. . . . No motive aroused them till the silver pence were presented; this lighted up their eye and warmed their heart. . . . Habits, our second nature, held them as with an iron grasp.' He resolved, therefore, to try his first experiment with the young, who, 'because most plastic,' were most hopeful.

Sabbath-schools were at that time suspected as being a political organization. When, a few years previously, Mr. Stow's father had formed a Society to institute such schools, the Sheriff of Renfrewshire requested the teachers to register their names at the Fiscal's office and take the oath of allegiance. Mr. Stow was thus prepared for any lack of sympathy with the establishment of a Sabbath evening-school: but, in the strength of his convictions, he persevered, nothing daunted even by the avowed hostility of influential persons who denounced his 'fanaticism' and 'excessive zeal.' Vagrant children were gathered at random, in the first instance, from the 'front streets only;' but as their residences were distant and far apart, it was found impossible to bring personal influence to bear upon their homes by frequent visitation. Another plan was therefore adopted. Two densely-peopled lanes in the Saltmarket, containing about seventy families, supplied about thirty boys and girls, and twice a week Mr. Stow visited their homes and gained the confidence of the parents, who thus became personally interested in the success of the school. The visible results of his labours in this debased district where there was a 'sad community of ignorance, rags, and filth,' were in every respect encouraging to the patient teacher; and the adoption of the local system of Sabbath-schools by Dr. Chalmers was consequent on this successful experiment of the youthful enthusiast. At that time Mr. Stow 'believed this system itself to be adequate to the regeneration of the people.' For several years, though carrying on an extensive business, this young merchant, by a strict economy of time, was able to give much assistance to Dr. Chalmers in working out many schemes of benevolence. He was appointed a deacon in 1821; and, notwithstanding the great difference of age, became one of the Doctor's most intimate friends. His best energies, however, were given to the establishment and working of schools; and when, after lengthened experience, he found that facts did not confirm his 'faith in the efficiency of the Sabbath-school system to renovate the whole social fabric,' he began to plead for the training of the young during the whole week, so that the six days' training to evil in the streets might no longer counteract the effect of the brief period of the one Sabbath evening. He tried to persuade all whom he could influence of 'the necessity of changing street training into school training, and of bringing the power of habit during the whole week to the side of religion.' This conviction led ultimately to the development of the Training System, whose principles and methods are based on the 'power of habit.'

There was one feature in Mr. Stow's Sabbath-school work which merits attention and imitation by those who would attain a like success. An earnest desire for the welfare of the children in his school led him to study all the circumstances under which their characters were moulded. His system of visitation unfolded many a page in the social volume, which instructed him how the better to restore life and blessing where what remained of good was 'ready to die.' Families were gladdened by his sympathetic voice, and his unsparing efforts for the welfare of the younger members ever secured a cordial welcome. 'Don't go with a paper in your hand,' said he, in his own cheery way, to the young visitors; 'the people will have an idea that you are collecting taxes. Knock at the door, tell pleasantly your purpose, and speak kindly to the children. The way to the parents' heart is through the child. You might as soon send a lion or a bear to attract children as some visitors whom I have seen. Do not speak to parents and children as if you had on a soldier's collar. Don't be gloomy; and remember also you will never get children to look confidingly to you with your chin buried solemnly in your bosom.' His own visits were said to have an abiding charm, and in the dark slums, where he carried on what he quaintly called his 'deep-sea fishing,' he succeeded in dredging up from the lowest social depths many a sinking or sunken one in the network of his good-natured and Christian sympathy.

The 'sunken classes' were not only callous, but coarse; and the vulgar cruelty of the young foreshadowed the probable future. Mr. Stow's first experiences were not encouraging. 'On the night of his opening his school he encountered much rudeness. No sooner was the class arranged, and had prayer begun, than the lights were extinguished. When rekindled, Mr. Stow was alone; the class had escaped. He cheerfully resumed his visiting of every family, and, without uttering a single complaint, he won back all his pupils and secured obedience.' 'A bold and restless boy, ragged and barefooted, had entered the class; lines, the shadows of cunning, were already traced on a naturally frank and open countenance. Placed on the third seat from the front, the temptation was great, and he yielded to it. Having ingeniously taken hold of a large pin with his toes, he darted it against the bare feet and legs of as many as he could reach of those before him; they leaped yelling from their seats, and he stood in their midst apparently alarmed by this unexpected turmoil. On discovering

his conduct, Mr. Stow neither denounced nor expelled him, nor did he adopt the clumsy expedient of sending him to another seat; but he reasoned with him as to the pain he had thoughtlessly given his classmates, and as to its continuance after his fun ended. He appealed to his sympathy and won it. In the course of a short time he gave him charge of the candle-lights, and by no awkwardness in snuffing them were they ever afterwards extinguished. The boy became an enthusiastic scholar.'

These incidents show that Mr. Stow possessed one of the chief elements of a true teacher's moral character. 'Gentleness, patience, and reasoning, even with such rude boys, proved to be a greater power than the rod, and he repudiated both corporal punishment and expulsion. In every instance of obstinacy, his mild, yet firm and decided looks and words speedily effected what neither blow nor bawling could have so fully effected.' One frequent resource was private reasoning with offenders, and he thus secured from them almost invariably a more consistent obedience than the harshest measures could have compelled. To most of his Sabbath scholars such kindly treatment was a new experience. 'He appealed to the higher principles of their nature, impressed them by the power of the Word of God, and overawed them by the solemnity of prayer. He succeeded in winning them to order and truthfulness, and to a respectful obedience, which was chiefly based on love to himself.'

The mode of conducting the class was new in other respects. Mr. Stow always explained the meaning of the psalm to be sung, or of the verses of Scripture, *before* they were committed to memory. In these efforts to impress divine truth on the mind, he discovered the value of vivid illustrations, and developed the method of 'picturing out in words.' Happy in himself, and happy in his work, 'the class was happy in his presence. The attention and interest of all were sustained by his close questioning, and he stimulated the thinking power of each by affectionate liveliness, impressiveness of manner, and the striking nature of the varied illustrations which he used.'

When younger children were introduced to the class, 'it was found there was a lack of sympathy between those of different ages.' The little ones were taught separately, and Mr. Stow then noticed what he termed the 'power of sympathy among children of nearly the same age,' and afterwards applied it in his System as an aid to instruction and to moral training.

Mr. Stow witnessed with satisfaction the gradual establishment of kindlier relations between the different ranks of society, as one happy result of his school; but, amid the incessantly active forces of evil, the need of day-schools, permeated with the spirit of the truly Christian Sabbath-school, was constantly pressed upon his mind. In 1824 he began to urge this conviction upon his friends; and, in 1826, ten years after he had begun his work in the Saltmarket, he founded the Glasgow Infant School Society, with the object of *training* little children in week-day schools on the principles and methods which had been independently developed in his Sabbath-school. A house and garden in the Drygate were taken on a short lease. A 'gallery' of raised seats accommodated about a hundred children, and the garden was turned into a playground, which, as an 'uncovered schoolroom,' was, in Mr. Stow's view, a *necessary* complement, as affording opportunity for the study of character. Mr. David Caughie, a young man of Stranraer, was selected as the first teacher, and soon gave full evidence of his fitness. 'Earnestly devoted, loving his work as a Christian teacher, patient, lively, buoyant of spirit, and lightening his labour with fitful gleams of natural humour, he soon proved a model infant trainer, gained the respect of the directors, and faithfully represented in practice Mr. Stow's principles.'

This obscure school-house was the first home of the Moral Training System, and it was in this college in the Drygate that teachers first received systematic training for their work.

Under the new system the pale, ill-clad, and ignorant children soon became healthful, cheerful, and intelligent; and, as these results became known, a selected number of little ones were, on invitation, taken to several towns to attract the attention of the public, and thus to promote the extension of the system. The plan was in this respect very successful, and 'Trainers' from the Drygate Training School were soon required for many important places in Scotland.

To conciliate the more thoughtful working classes, and to explain in a popular way the principles of the 'new-fangled schooling,' Mr. Stow about this time (1829) wrote in admirable Scotch a dialogue entitled 'Granny and Leezy.' The following extract will be interesting not only on educational grounds, but as showing a ready insight into character, and a power of delineation 'even in its subtler forms with humour and exactness':

[*Granny visits the Model School for training Infants, raps* (knocks) *at the outside gate of the Play-ground, which is opened by the Children at Play.*]

Granny. Weans, is this the schule?

Weans. The Infant School do you mean, Mem?

Granny. Ay, to be sure—let me in, my braw bairns.—Whar's the Maister?

Weans. There he's, Mem, at the other end of the play-ground, near the school; he was just swinging a little with the boys.

Granny. Swinging—swinging—Maister an all—A fine schule to be sure—let me see him.

Weans. Take care, take care, Mistress, else the boys will knock you down, for they're swinging.—*Twenty-eight—twenty-nine—thirty.*

Granny. What's that they're saying, Weans?

Weans. They're counting their turns, Mem.

Granny. Counting their turns! what can that mean?—Let me out o' the road, Weans. Ye're just like a skep o' bees, ye wee tots—tak' care my staff disna hurt your taes, ye wee bits o' things—stand a' back noo, but ane—ane's eneugh to let me see the Schulemaister. (Mary runs to meet her grandmother.)—Granny.—*Is this you, Mary,—my bonnie thing?*

Weans. Mary says this is her ain Granny.

Master. Come in, Mistress, you seem fatigued—you had better take a chair near the fire, and rest a little.

Granny. Deed, I hae muckle need to rest, there's sic a crowd in this place; it's just like a 'cried fair.' Deed, I was amaist like to be knockit down, gin it wasna for the flock o' weans, who were very ceevil, puir things, takin' me out o' the road.

Master. Just rest a little, if you please, while I call in the children from the play-ground. After each hour or half-hour's lessons in the school-room, we allow them a few minutes out-of-doors, to play.

Granny. Weel-a-weel, play's a' richt, but what's half-an-hour to do in the way o' perfecting in reading? In my young days, we sat hale three hours at a time in the schule, and durstna turn the side o' our head a' the time, for fear o' the taws whiskin' past our lugs, (ears,) and maybe a loofie (palmies) or twa to the bargain—but we'll see, Maister. Now, to be honest wi' ye, I hae just come this morning to search to the bottom o' this thing; for I hae twa oes (grandchildren) in this schule contrar' to my will, and I ha'e their spiritual weelfare constant at heart;—and frae a' I ha'e heard, I canna say that I'm just owre weel pleased wi' what I hear.

Master. Well, Mistress, I like candour; and if you will have a minute's patience till the children are all in, I shall be happy to——

Granny. Stop there, Maister—stop. I see by your een ye're going to wheez me o'er wi' a word o' flattery; but mind ye, lad, that'll no do.—Schulemistress, stop the weans frae coming in at

the door there, till I get my breath out; that maun I. Maister, steek (shut) the door, gin ye please.

Master. Well, Ma'am, the door is shut. What important matter is now to be brought under discussion?

Granny. Decussions, or what ye like; I want, Maister, to speer a plain quastion. Whatfor do ye, as I'm tauld ye do, bring down a maister's dignity, and condescend to play wi' weans, swingin' and lampin' round *a big stab* there, like a muckle gawky? What commaun' can ye expect to ha'e after sic pranks?—Answer me that, Maister, and tak' care what ye say, for they tell me there's nae leeing here, and I'll be a witness to the truth o' the observe—that will I.

Master. Now, Mistress, when you stopped me so abruptly, I was about to have said, that I shall explain everything to you; and it will afford me much pleasure showing our plan of teaching and training to a person of the venerable age you appear to be.

Granny. Nae glamour noo, Maister,—to the point, if ye please.

Master. Well, Madam, respecting playing with the children, you know the first and most important object, in rearing up children 'in the way they should go,' is to gain their affections.

Granny. O ay, that's true, but what syne?

Master. And we think this important point is more easily and effectually gained, by being quite at ease with the little ones, rather than by keeping at a distance, and awakening fear in their tender breasts, instead of love. You will acknowledge, I believe, that the service done to a person you love is more heartily performed, than when fear is the animating principle. You will recollect, Madam, it is said,

> 'Love still shall hold an endless reign,
> In earth and heaven above,
> When tongues shall cease, and prophets fail,
> And every gift but love.'

Granny. Ay man, I see ye hae gotten some o' the Paraphrases by heart—that's sae far, to be sure; but swingin' on ropes—whatfor that, Maister, ken ye?

Master. Well, I was about to have said, that we conceive one most distinct method for parent or school-trainer to gain the affections of children under their care, is to enter into all their little amusements, at least occasionally. Children highly value this condescension on the part of their teachers, and the contrast in age is so great, that no child will respect a teacher the less on account of having had a game at ball with him, or even a swing, to which you seem to have such mighty objections; but, on the contrary, I would say, to offend such a master or parent would be a matter of regret on the part of the children. Under such circumstances, he is an object of love, but never of terror. You know that God in Christ has condescended to many of our weaknesses and infirmities, in order to gain our affections—though never to our sins. With these God could have no sympathy.

Granny. Sins, sins—na, na—God couldna do that. I was amaist fear'd ye were gaun wrang, lad—but ye brought yoursel' out no that ill at the hinder end—tak' tent o' thae kittly bits: na, na, God never can look at sin but wi' the outmost abhorrence.

Master. Madam, I find the children must be let in. They have been quite long enough in the play-ground, and I fear it begins to rain. I shall ring the bell, and the mistress will lead them all in.

Granny. Come awa,—come awa,—ye wee tots—what a flock! I'se warrant there's twa hundre' amaist.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

IT has always appeared to me that the main work of an educator is to teach 'how to think.' This is, indeed, nothing else but to train human beings to become in reality something different from the lower animals. But before we set about this 'development of the powers of mind' as we call it, would it not be well for us to know at least a little about this 'mind?' A teacher altogether ignorant of psychology is to a great extent working at random. Every reader of the *Governess* most surely has seen in those able articles of Mr. Coupland's on the 'Discipline of the Mind,' how intimately the principles of psychology are connected with the principles of education. In fact, as gravitation is the key to the physical sciences, and evolution the key to the biological sciences, so most assuredly is psychology the key to the science of education. Most of the superstitions, whether political, religious, or scientific, that now hang over us like thick black clouds, will vanish as soon as we teachers have educated the masses 'to think.' In these lessons the reader will by this time have seen that I have always proceeded in this sequence:—1st, the boys observe; 2nd, they experiment; 3rd, by experiment they ascertain facts; 4th, they put facts together, draw conclusions, and so arrive at laws. I think this is the true scientific mode. At least I know that this is the manner of investigation adopted by our leading men of science:—Darwin, Tyndall, Huxley, etc. And why should not we, in our humble way, when working out our little conclusions with the boys, follow the same method? Those teachers who are content with teaching only the laws and conclusions of No. 4, do but instruct; those who, in addition, pass through stages 1, 2, and 3, also educate.

The following is an outline of a lesson upon the 'inclined plane.' The apparatus figured in No. 5 PRACTICAL TEACHER stands upon the table. The references are of course to that illustration. The screw W and the block X are removed, and the plane is placed so that A_5 is at Z; and A_4 on the brass rod V in the top hole. I begin the lesson.

Did any of you boys see some men bringing heavy barrels into the playground this dinner-time? Ans.—Yes, sir, they are going to put some new asphalte in the playground. Yes, but you are not quite right; it is tar-paving, not asphalte, they are going to put down. Well, did you see the men trying to lift the barrels up the step by the door? Yes, sir; three men tried at one barrel. Could they do it? Ans.—No, Mr. Marlow went and got a board. Well, what then? Ans.—They put one end of the board on the step, and then two men rolled up the barrel. Two men? Ans.—Yes, sir. And you say that three men could not do it without the board. Have you ever seen something like this done before? Ans.—Yes, sir. I saw some men getting a large barrel of sugar into a grocer's shop. I saw two men rolling a large barrel up into a brewer's dray. Very well. Why did these people adopt this plan of raising the barrels? Ans.—Because they found it easier than by lifting them up by hand. Supposing the men could not have rolled up the barrels of tar even with the board Mr. Marlow brought, do you know what they would have had to do? Ans. (after a pause).—They would have had to get a longer board. Just so. How much do you think one of those barrels weighed? Ans.—About two hundred-weight. Yes, a little over that I should say. Well, do you think the men pushed with a force of two hundred-weight to get the barrel up? Ans.—No sir, less. How much less? No answer. Well, let us try to find out by experiment how the matter stands. Perhaps we shall be able to find out exactly what this gain of power depends upon. Here you see is an inclined plane (Fig. 3). It is three feet long, and the end (A_4) is raised just one foot. We will call this 'one foot' the perpendicular. What is the ratio of the perpendicular to the length to the plane? Ans.—As 1 to 3. Very well. Farmer, you can come out this morning and write the notes on the board. Put

down, perpendicular height is to length of plane as 1 to 3.

Per. : Len. of Pl. :: 1 : 3.

You see we have a small carriage, it weighs exactly one pound. Put that down, Farmer. Jones, you can come out here. Now I am going to let Jones put various weights in the carriage and see what weight hanging on here (A_3) will balance, then we shall be able to say what is the exact weight that will draw up the carriage. But before we do this, is there nct something else we must settle? Ans.—Yes, sir; there's the weight of the carriage. Ah! yes, but we can always add one pound for that. (Another boy)—There's the friction of the wheels to take into account. Very good, Smith, that is just what I wanted to get at. Now, how shall we find out what to allow for this friction? Ans.—See what weight will draw up the carriage by itself. (Another boy)—No, that won't do, because that would be taking into account the weight of the carriage as well. Of course it would, Howell; then what must I do? Ans. (Howell)—Put the p'ane quite level, then see what weight will draw it along. Very good. Jones, take out the brass rod, place it in the third hole, now put the other end of the plane on the block (Z). Now it is level. Put on a weight (at A_3). You see we hav'nt one small enough; try this penny. It is quite enough to draw the truck along. There is so little friction, therefore, that we need not take it into account at all. Why, think you, is the friction here so little? Ans.—Because you have put down rails on the plane. (Another boy)—And have brass wheels. (Another boy)—That is why they put down rails for the tram cars. Yes, and on the railway as well. (A boy)—That's why it's called a railroad. (Another boy)—Nearly all the roads are railroads now. Very well; now, Jones, place the plane as it was at first. Now put a two-pound weight in the truck, see what weight at A_3 will maintain equilibrium, or balance the truck in the middle part of the plane. Ans.—One pound. Good. If we let the weight at A_3 represent the power and the truck the weight, tell me what *is* the power. Ans.—One pound. And the weight? Ans.—Three pounds. Farmer, write that down. Farmer writes—

P = 1 lb. W = 3 lbs. or as 1 : 3.

Now place this six-pound weight and this five-pound in the truck; how much in all? Ans.—Twelve pounds. Now, Jones, find what weight will balance. Ans.—Four pounds. Good. Farmer, write that down. Farmer writes—

P = 4 lbs. W = 12 lbs. or as 1 : 3

Very well, now both go to your places. I will now put a nine-pound weight in the truck, perhaps you can tell me now what weight I must put on to balance. Ans.—Three pounds. How did you know that, French? Ans.—Because the power is always one-third of the weight. (A boy, Howell)—It is *there*. What do you mean, Howell, by saying 'it is *there?*' Ans.—It's a third there, because the height of the plane is a third of the length, but if you put the brass rod down another hole, it won't be so. Now look, boys. Howell says this: that with the height as it is now, three pounds balances nine pounds, but if I lessen the height, it would not be so. Well, Howell, come out here: shift the brass rod to the second hole; you now have the height half a foot. Find what weight will now balance. Ans.—One and a half pounds. You see, boys, Howell is right. (A boy)—Please, sir, the less you make the height, the less the power is. (Another boy)—I can see the rule. Can you? What is it? Ans.—When you had the height one-third of the plane, the power was always a-third of the weight, and when you had the height one-sixth of the plane, the power was one-sixth of the weight; so the power is just the same part of the weight as the height is of the plane. You have the right idea, Drayson; now can any boy come and write what Drayson says, as a proportion? Let 'h.p.' stand for the height, and 'l.p.' for the length of the plane. No one can do it? Well, listen; we have been talking about four quantities, viz., the weight, the perpendicular height of the plane, the power, and the length of the plane; I want some boy to come and write out those four quantities in the form of a proportion. (A boy)—I can do it, sir. The boy writes—

P : W :: h.p. : l.p.

Very good. Now suppose the weight is 100 lbs. and the height 4 feet, and you can employ a force or power represented by 10 lbs. only, what length must the plane be? Drayson writes—

10 : 100 :: 4 : l.p.

$$\therefore \text{l.p.} = \frac{100 \times 4}{10} = 40 \text{ ft.}$$

You see, boys, this proportion will enable us to work any sum about the inclined plane. The boys who are out can now go to their places. All copy into your books what is on the black-board.

(To be continued.)

—o—

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

NO. XV.—THE DIPTERA.

BETWEEN the *Homoptera* and the *Diptera* is placed the small and comparatively unimportant order of the *Aphaniptera*, the members of which are popularly known as Fleas.

The word *Aphaniptera* signifies 'non-appearing wings,' and is a very appropriate title, the organs of flight being utterly useless for their legitimate purpose, and being merely represented by four extremely minute scales upon the thorax. So small are these scales, indeed, that they can only be seen by means of a high power of the microscope, and even then are so unlike the wings of other insects that their real nature would scarcely be imagined except by an entomologist experienced in insect anatomy.

Space being unfortunately limited, we can devote but a few lines to this order, which, although unimportant and comprising comparatively few members, yet affords us many features of interest. We will therefore pass to the *Diptera*, or two-winged flies, which constitute the last order in the present classification of the insect world.

The word '*Diptera*' is not as appropriate a title as might be desired, being of a rather misleading nature. It is true that in the insects of this group two wings only are visible upon a cursory examination.

But this is in outward seeming only, for all four wings are present, although the lower pair are found in a curiously modified form. Few, indeed, would recognise these for wings, or modifications of wings at all, the two tiny bristles, each tipped with a small round knob, apparently having nothing in common with the broad, membranous organs which bear their owner so swiftly through the air.

Yet, small and unimportant as these '*halteres*,' or 'balancers' appear, they yet seem to be of vital importance in the flight of the insect, for it has been found that if they be removed, or otherwise damaged, their owner loses the power of directing its course, and can only flutter helplessly along the ground, like some moth whose too inquisitive turn of mind has led it to practically experience the properties of a gas-flame. Even in many Diptera, whose upper wings are only rudimentary, the halteres are present, which would lead us to suppose that they have other functions besides that of assisting in flight, and of which we can form no conjecture.

The upper pair of wings are of much the same nature as are those of a bee or wasp, but have at their bases two small appendages, looking somewhat like an additional pair of rudimentary wings. These are generally known as 'alulets,' or winglets, the object of which is not clearly understood.

Professor Westwood has divided the *Diptera* into two great sections; the first of which he terms *Cephalota*, the head being distinct from the thorax instead of being sunk into it. This group he again divides into smaller families, the *Nemocera*, or 'Thread-horned' flies holding the first place in his arrangement. In the insects of this group the antennæ are composed of more than six joints, the palpi having either four or five joints.

This division includes some of the most widely and universally familiar of all of our British *Diptera*, namely, the gnat and the daddy-long-legs.

In spite of certain unpleasant features in the character of each, both these insects are of wonderful interest, and will repay the most careful and protracted examination which can be bestowed upon them. We will begin with the former, known scientifically as *Culex pipiens*.

Excepting by those favoured individuals who are exempt from its attacks, the gnat is generally regarded as an insect whose sole mission in life is to torment the human race, and therefore as one which should be discouraged in every possible way. And yet, like many other creatures placed in the same category, the gnat is far less black than it is painted, and, indeed, by the nature of its food during the earlier stages of its existence, actually confers a benefit upon mankind by preventing miasma from arising from the putrid substances found in the stagnant ponds in which it dwells.

The life-history of the gnat is of a most wonderfully interesting nature, from the moment at which the eggs are deposited by the parent until that when the perfect insect emerges from its pupal shell, and soars aloft to make its first journey through the air, of which, for the remainder of its existence, it is to be an inmate.

To begin with, the eggs are deposited upon the surface of the water in a very singular manner. Resting upon some small twig, or other floating object, the parent gnat crosses her long hind legs behind her, and places a single egg in the angle formed by them. This egg, which is long and spindle-shaped, is then transferred to the water where it floats upright, little more than half being actually submerged. A second follows in a like manner, and is firmly fastened to its predecessor by some cement which is not affected by the action of water. This is in its turn followed by a third, and so on until the whole number of its eggs is deposited.

When this is the case, the egg-mass is seen to form a kind of boat, much resembling a carraway seed, both in size and appearance. This floats upon the surface of the water, and, by the peculiar method of its construction, can neither be sunk nor upset. It may be forcibly submerged, but will return to the surface immediately upon being released, and, discharging the water which it had taken in, at once regain its former position. Indeed, the whole structure of the egg-boat of the gnat is so exactly that of the present self-righting lifeboats that we cannot but wonder whether the inventor of the latter did not take a lesson from nature, and build his boat upon the principles of one which probably existed long before man came upon the face of the earth.

After the expiration of a few days a small door, so to speak, opens in the submerged end of each egg, and the young gnat larva dives into the water which is to form its home throughout the earlier stages of its existence.

The appearance of the young grub is rather remarkable, the head being very large when compared with the size of the body, and the tail furnished with a forked appendage, connected with the respiratory apparatus. These larvæ may be found in numbers during the summer months in any stagnant pool or ditch.

In due course the larva passes into the next stage of its development, and becomes a pupa. It is still able to travel through the water as before, but can no longer take food, all the organs of the mouth being enveloped in the outer covering. After a short time, the pupal skin cracks along the back, and the perfect insect slowly emerges, using its late covering as a kind of raft upon which to rest until the wings have attained their full strength, and are able to bear their owner into the air.

Just as is the case with the bee and wasp, and other stinging *Hymenoptera*, the male gnat is altogether harmless, and is quite incapable of inflicting the unpleasant wounds caused by his gentle spouse. The distinction between the sexes in outward appearances is evident even to a casual observer, for the antennæ of the male are beautifully plumed for almost the whole of their length, while in the female these organs are feathered only in a very slight degree.

The apparatus by which the female gnat inflicts the wounds which cause her to be regarded with so great abhorrence by the victims of her attacks is of a rather complicated nature, and cannot be very easily described by words alone. The beak consists of no less than seven separate parts, which are, in fact, modifications of the different parts of the mouth, and are not supplementary organs, as is generally supposed to be the case. The upper lip becomes a broad and hollow lancet: the mandibles are developed into long serrated organs, adapted for the purpose of piercing the skin; the maxillæ are somewhat similar in form, but are very much more slender and delicate; the tongue, again, is represented by a very long and needle-like

instrument, while the lower lip forms a kind of sheath which encloses these various weapons when not in use.

The peculiar irritation caused by the bite of the gnat is due to the saliva, a small portion of which is introduced into the wound by the insect in order to cause the blood to flow more freely. This acts with greater or less severity upon different individuals, some suffering greatly from the bite of the insect, while others seem little, if at all, annoyed by the wound.

When placed beneath a tolerably high power of the microscope, the gnat becomes a most wonderful and beautiful object, fully repaying any care and attention which may be expended upon its examination. The wings, the body, the limbs, and even the beak itself, are seen to be covered more or less closely with beautiful scales, very much resembling those of the Lepidopterous insects which have been described in preceding papers of this series. All the colours of the rainbow seem to play over the body, while new glories show themselves at each fresh glance, giving the observer some slight and imperfect idea of the wonderful beauties to be found even in the commonest and most despised of the inhabitants of the insect world.

The well-known Daddy-long-legs, or Crane-fly (*Tipula longicornis*), must be ranked amongst those insects which are directly injurious to man, the larvæ feeding upon the roots of various grasses, which in some cases they so destroy that the turf may be rolled up by the hand as readily as if it had never been attached to the ground beneath. Indeed, were it not for their natural enemy, the starling, the damage caused by these grubs would be altogether incalculable, and would well entitle them to take rank amongst the bitterest foes to our lawns and pasture-land. Even as it is, they are quite destructive enough, and in some seasons swarm to such a degree that acres upon acres of grass land are completely ruined by their depredations.

There are many species of crane-flies, some of which, like the gnat, are inhabitants of the water until they attain to their perfect condition. In one genus, *Chironomus*, these grubs are of a bright scarlet colour, and are sometimes the cause of a somewhat peculiar, and at first sight mysterious, phenomenon. In damp and marshy ground, perhaps a small pool or two may be seen in which the water appears to be of a dull reddish colour, just as though a considerable quantity of blood had been mingled with the contents. As the observer approaches, this red hue suddenly vanishes, and the water assumes its normal appearance. Should he remain quiet, however, the reddish colour gradually returns, until the pool appears just the same as before his approach.

This strange phenomenon is due to the scarlet grubs of the *Chironomus*, which are present in such numbers as apparently to redden the water of the pool. At the least sign of danger they dive into the mud beneath, remaining there until quiet is again restored.

THE next division of the Cephalote *Diptera* is known as the *Brachocera*, a word signifying 'short-horned.' In these flies the antennæ never consists of more than three joints, while two, and in some cases one only, are found in the palpi.

A well-known member of this group is the Gad-fly (*Tabanus bovinus*), which forms so great an enemy to cattle in this country. It does not, however, confine its attacks to these animals alone, but often forms a very unpleasant foe to man himself, driving its long and sharply-pointed lancets into his skin, and inflicting a decidedly painful wound. As is the case with the gnat, the male is harmless, all these unpleasant attacks proceeding from the female alone.

On account of its wonderful likeness to a bee, the Drone-fly (*Eristalis tenax*) would scarcely be taken for a dipterous insect at all, and there are few people who would care to handle a specimen until they were thoroughly assured that the resemblance ended with its outward appearance.

The chief interest of the drone-fly lies in the larval stage of its development, at which period of its existence it is certainly a most wonderful creature. It is then known as the Rat-tailed Maggot, a title which it derives from the very curious formation of the respiratory organs.

Dwelling, as it does, immersed in the most fetid and noisome mud which can well be imagined, the requisite supply of air would seem to be utterly unattainable. But this difficulty is overcome by the remarkable structure of the tail, through which the breathing tubes run, and which bears a wonderful resemblance to a telescope, being capable of considerable expansion and contraction. Thus, although the whole body may be completely buried in the mud, the extremity of the tail can yet project above the surface, so that a constant supply of air is assured to the larva.

Should any signs of danger appear, this telescopic tail is instantly contracted, and does not resume its functions for some little time.

Taking into consideration the nature of its food, we may rank the drone-fly amongst our more particular insect benefactors, for there can be no doubt that by its agency a vast quantity of putrid matter is annually consumed which would otherwise in all probability give rise to miasma, and so cause fevers and agues to a very considerable extent.

When the time for its change to the pupal condition approaches, the drone-fly larva emerges from the mud which has previously formed its home, crawls ashore, and buries itself in the ground, whence the perfect insect emerges in due time. The fly is extremely plentiful, and may be found in great numbers throughout the summer and early autumn, either hovering over flowers, or basking in the warm rays of the sun.

Passing of necessity by many very interesting insects, we come to the vast family of the *Muscidæ*, more than a thousand species of which are known to inhabit Great Britain alone. Of these we will take two or three examples, the first of which shall be the common and well-known Blue-bottle, or Blow-fly (*Musca vomitoria*).

This is another of the many insects which are popularly supposed to be created for the sole purpose of annoying mankind, whereas in reality their services can scarcely be over-valued. It is true enough that the blow-fly is very troublesome in our larders during the heat of the summer, but, if we set this trifling annoyance in the scale against the great benefits which it confers upon us in other ways, we shall see that it ought in reality to be placed in the foremost rank of our insect friends.

For the blow-fly is one of the most untiring co-adjutors of the burying beetles, the cocktails, and the various other insects whose larvæ find their food in decaying animal matter, and which ought, therefore, to be protected and encouraged to the utmost of our power.

No sooner does any neglected animal matter show the least signs of incipient decomposition, than the blow-fly, together with its many assistants, makes its way to the spot, and commences its beneficent work by depositing a vast quantity of eggs. These very shortly hatch, and the young grubs immediately begin upon the great business of their lives, viz., that of eating, from which they never cease until the time arrives for them to assume the pupal form. They then bury themselves in the ground, and become hard, cylindrical, brown objects, not quite a quarter of an inch in length. In a wonderfully short time the perfect insects emerge, and at once set off in search of sustenance for the next generation.

The Flesh-fly (*Musca carnaria*) greatly resembles the blow-fly in habits and life-history, differing from it, however, in one important particular. For, while the blow-fly places eggs upon the putrid matter which it selects as food for its future offspring, the flesh-fly deposits living larvæ, these having hatched within the body of the parent. If the abdomen of a flesh-fly be opened, these grubs may be seen lying in two long rolls, each of which contains some five thousand larvæ.

The wonderfully rapid rate at which these flies multiply may thus be imagined, and when we reflect that the entire development of the insect is completed in the course of a day or two, we can understand the remark made by Linnæus, that three flies could eat an ox as fast as a lion.

Many of the *Muscidæ* are parasitic within the bodies of various caterpillars, just as is the case with the Ichneumon flies described in a previous article.

We must not omit to mention the well-known Bot-flies (*Œstridæ*), so familiar to us from their parasitic attacks upon various animals.

One of the most plentiful of these is the common bot-fly (*Gasterophilus equi*), which always selects the horse as the victim of its attacks.

The egg is placed by the parent insect upon some hair within easy reach of the horse's tongue. Before long, the spot is licked by the animal, and the egg carried into the mouth, whence it shortly passes to the stomach. Here the grub emerges, and seems to feed upon the secretions of that organ.

During the winter it remains within the body of the horse, but in the spring loosens its hold, passes through the intestines, and makes its way to the ground, in which it burrows in order to assume the pupal condition.

It is a mooted point whether these larvæ, many hundreds of which may often be seen within the stomach of a single horse, are productive of harm to the animal. It can hardly be supposed that their presence within the body can be beneficial, and yet it is impossible to detect any actual harm caused by their parasitic habits. As, however, it would seem that they must extract a certain amount of nourishment from the secretions of the stomach, we can only conclude that they must, although, perhaps, in only a slight degree, weaken the animal in whose body they have taken up their abode.

A curious memorandum with regard to this group of *Diptera* occurs in the *Entomologist* for July of the present year (Ent. xv. 164):—"At one of the meetings of the International Medical Congress, Dr. W. G. George stated that a girl, aged twelve, presented herself with the following history:—About three months before being seen by a medical man an ovoid swelling appeared on the outer side of the ankle, causing her some pain and uneasiness in walking. This swelling gradually shifted its position, and slowly moved up the leg, thence towards the right axilla, then down to the elbow, and finally settled on the back of the neck. In this position a small dark spot appeared, an orifice formed; and when pressure was made around this opening, a white grub, nearly an inch in length, protruded, and escaped along with some unhealthy pus. Several other similar swellings developed upon subsequent occasions under medical observation, and the medical man extracted other grubs, exactly similar to the first specimen. No cause could be assigned for these curious phenomena. The larvæ were pronounced by competent authority to belong to a dipterous insect, although the genus could not be satisfactorily determined. There was no sufficient proof of the existence of an *Œstrus* peculiar to man alone."

We must now pass to the second of the great divisions of the *Diptera*, namely, the *Thoracocephala*, or those in which the head is buried in the thorax.

Space will allow us to describe one member only of this group, namely, the common Horse-fly (*Hippobosca equina*).

This insect, which torments horses so greatly by its determined attacks, is chiefly remarkable for its extraordinary method of reproduction. It will be remembered that in the flesh-fly above described the eggs are hatched within the body of the parent insect. In the horse-fly, however, whose offspring is limited to one, the whole growth of the larva takes place before it enters the world, in which it makes its appearance in the pupal form. This strange method of reproduction appears to be confined to this groupof insects.

We have now arrived at the end of our task, and have given a short and necessarily incomplete sketch of the insect world. In conclusion we have only to hope that some few of our readers may be induced to take up for themselves a study which is second to none in the beauty of its objects, the interest of their life-history, and the wonderful and yet simple nature of their structure; and we feel certain that none who may do so will ever find cause to regret their determination.

How I Teach Swimming.

BY THOMAS GARDNER,

Member of the London Schools Swimming Club.

BEFORE proceeding with hints on other styles of swimming, it will be well to notice concerning the use of rope and plank, that the former must be held or fixed taut, and that the latter if loosely floating would be of little if any service. The body must be at such a level that the shoulders are under water. Without weighting an unattached plank this would be evidently impossible. Again, it will not be well to suggest to lads the use of loose planks, as these are much given to turning over at but slight provocation, thus preparing for the novice an unpleasant and bewildering surprise. Given the requisite adjustment, however, both rope and plank will be found decidedly serviceable where the number under tuition is much larger than that of teachers and assistants.

For individual teaching, nothing is better than the supporting hand of a practised teacher, unless it be the suspending rope and belt. Even when such individual support can be afforded, the simultaneous drill by the head master will be equally practicable and advantageous.

But now, two or three further meetings of the Club having resulted in the acquisition by most of the members of the elements of Chest Swimming, our seventh or eighth lesson shall introduce

'THE SIDE STROKE.'

'Didn't Waterman use the *side stroke* at the last race meeting?' or some such sly little speech has from time to time betrayed Smart's impatience to practice the more rapid method. 'Patience, Fidgets; Waterman won the long final race by being equally at home with both the breast and the *side stroke;* but a good long, steady sweep, and the most natural breathing, had been well mastered before his first lesson in the quicker style.' 'Yes, Sir,' chimes in Waterman, 'and I remember how unkind I thought you to refuse to proceed beyond breast swimming till I could take the breadth of the lake in thirty instead of sixty strokes.' 'Now, lads, see; I turn on my right side, and without changing at all the action of the legs, make a very decided improvement in my rate of progress.' 'You slip through the water instead of breasting it,' says Jones, who has been wonderfully sharpened by our Swimming Lessons. 'Once again watch carefully; and now, Smart, tell us how it's done.' 'Your right hand is shot out straight before your head, edgewise in the water, with the thumb upwards.' 'But,' says Slocomb, who is much better in describing a thing than in doing it, 'your left arm was bent, Sir, with the back of your hand thumb downwards, close to your side.' 'Then, Sir,' adds Trickster, who is rapidly recovering lost ground, 'you brought the right arm round to the right knee with a strong sweep, and while it was returning to its right position, sent the water away behind, with left arms and legs together.' 'Yes, lads; only remember that the arm *beneath* you always *alternates* with the legs, while the upper arm moves with them, whether you are swimming on the right or left side; and note that if a change is really *quite* as good as a rest, when you can change from breast to right side, then to the left side, with a decided change of action for each, you ought to be able to go on swimming for ever.

'But now Waterman, Codling and Fisher, while the freshmen are dressing I should like you to practise for a minute

"THE OVER-ARM STROKE,"

which is only another variety of the *side stroke.* Instead of keeping the upper arm under water, move it into position for its stroke by a sweep through the air in a semicircle,—so;'—and my upper arm makes the curve through the air, and so down to the water, just in advance of my head. Meanwhile the entire body, the upper arm only excepted, is being propelled by the under arm, beneath the surface, the mouth or nostrils only appearing for an instant for breath during the stroke of the legs and upper arm. Even my clever young assistants find the utilizing of the right moment for breathing a somewhat difficult feat.

'This little difficulty will soon vanish, as others have done, and you will find this advantage in the *over-arm stroke,*—that even less of one's own weight has to be supported by this than by the other methods, since the entire body being much of the time beneath the surface, a greater quantity of water is displaced.'

Our meetings often wind up with

WATER GAMES,

which all have their use, and in which master and assistants are gradually joined by the apter pupils. Some are good practice in smart swimming; all tend to make the participators, master and men, more and more at home, and therefore readier for any emergency. Here is a little arrangement for the development of speed, which we call '*The Chase,*' and in which all can join who can swim moderately. Sides are chosen (any number may join), and a hollow ball, not too light, provided. A scorer, who may also act as umpire, has the names of each side, and starts the game by throwing the ball from the bank—where all are standing in line—well out into the lake. The ball touching the water, is the signal for a rush forward, and a rare struggle between the best swimmers on both sides. The ball touched, *ten* is scored to the successful boy and side. His part is now to throw the ball at least six yards, which will be raced after, and being secured, *two* is scored. The players on each side will try, of course, to play into their own hands, by throwing the ball towards their own men. The throwing itself is a little feat for beginners, and the throw is often less than six yards, or thereabouts, in which case '*no ball*' is shouted by scorer, and the ball given to the other side, who score *one.*

The side first scoring *thirty* wins, and *the best of three games,* and consequent victory is often the result of five minutes' sharp play.

As a game requiring and developing confidence, *leap-frog* may, amongst many others, be recommended. Codling and Fisher are specially clever at it. Codling *treads water*—the words exactly define the action—with his back to his companion, Fisher swimming briskly towards him from some twelve yards distance. The latter, approaching, places his hands on Codling's shoulders, pushes him well beneath the surface, and with a clever surface dive is a good twelve yards in advance of Codling by the time the latter has returned to daylight, and is ready for his 'run and leap,' alias swim and dive over Fisher, who is 'treading water,' and awaiting his friend's onslaught.

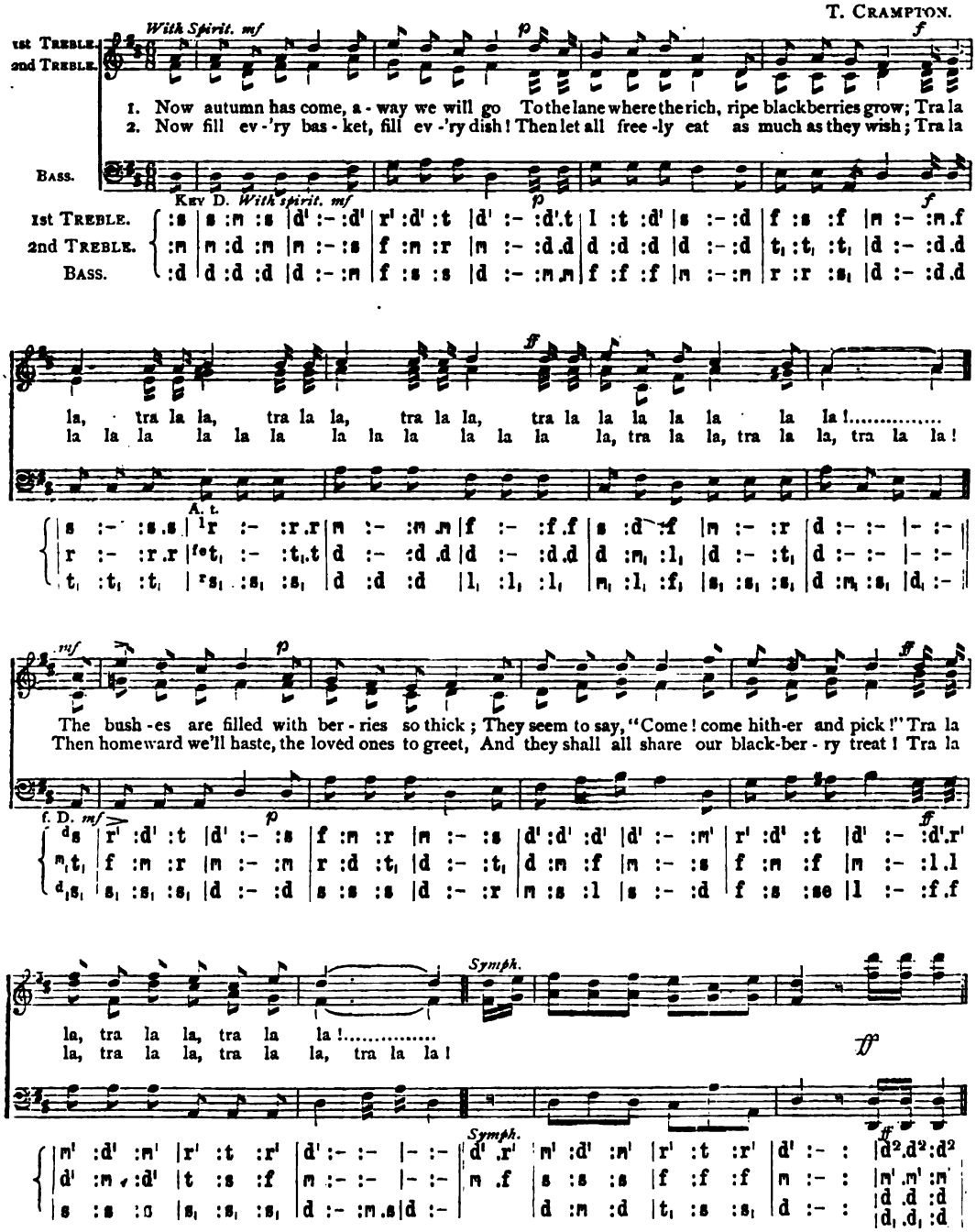
Somersaults, washing tubs, steamers, and mysteries without number, become facts accomplished by such dabsters as Swift, Smart, and Quickly,—such aptitude have these lads for tricks and sports. For my homilies on the dangers of *muddy bottoms, weeds, cold springs, currents, breakers,* etc., the park waters afford no means of illustration. Would that the dangers attending broken bottles were as little exemplified,—bottles which being brought for the stowage of 'sticklebacks,' have been detained by an ironical fate to keep them company.

Such homilies are, however, delivered, not seldom or without earnestness, for sure I am that Trickster, Smart, and Spratling *will* swim at every possible opportunity, and might, if unwarned, turn their recently acquired skill into an occasion for disaster. I will not say how many lessons we have now had; suffice it that at the very last, dear awkward old Slocomb whispered confidentially as we returned breakfastwards with flourishing towels and appetites, 'I really begin to hope, Sir, I shall be able to get across Lambeth Baths in October.'

And I believe he will.

GOING A-BLACKBERRYING.

T. CRAMPTON.


With Spirit. mf
1st TREBLE.
2nd TREBLE.
BASS.
1. Now autumn has come, a - way we will go To the lane where the rich, ripe blackberries grow; Tra la
2. Now fill ev - 'ry bas - ket, fill ev - 'ry dish! Then let all free - ly eat as much as they wish; Tra la
KEY D. With spirit. mf
1st TREBLE.
2nd TREBLE.
BASS.
la, tra la la, tra la la, tra la la, tra la la la la la la!.....
la la la la la la la la la la la la, tra la la, tra la la, tra la la!
A. t.
The bush - es are filled with ber - ries so thick; They seem to say, "Come! come hith-er and pick!" Tra la
Then homeward we'll haste, the loved ones to greet, And they shall all share our black-ber - ry treat! Tra la
f. D.
Symph.
la, tra la la, tra la la!.....
la, tra la la, tra la la, tra la la!
Symph.

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ANSWERS TO
Pupil Teachers' Examination Papers.
JULY 29TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. If 17 hogsheads weighing 14 cwt. each are purchased at £24 per cwt., at what price must the whole be sold in order to gain a profit of 2½d. per lb.?

(*a*) Cost price of whole = £24 × (17 × 14) = £24 × 238 = £5712 0 0

(*b*) Tot. prof. at 2½d. p. lb = 2½d. × 238 × 112 = 66640d. = 277 13 4

Total price = 5989 13 4

2. Find the value of 27 acres 3 roods 27 poles, at £7 10s. 8d. per acre.

		£	s.	d.
Value of 1 ac.	=	7	10	8
				27
,, 27 ac.	=	203	8	0
,, 2 ro. = ½ val. of 1 ac.	=	3	15	4
,, 1 ,, = ½ ,, 2 ro.	=	1	17	8
,, 20 po. = ¼ ,, 1 ,,	=		18	10
,, 5 ,, = ¼ ,, 20 po.	=		4	8½
,, 2 ,, = 1/10 ,, ,,	=		1	10 6/10
		210	6	5 1/10. Ans.

3. Compare the values of 777 articles at £3 7s. 10½d. each, and of 923 articles at £2 15s. 10½d. each.

		£	s.	d.
(*a*) Val. of 777 at £3 each	=	2331	0	0
,, ,, ,, 6s. = 1/10 val. at £3	=	233	2	0
,, ,, ,, 1s. 6d. = ¼ ,, 6s.	=	58	5	6
,, ,, ,, 4½d. = ¼ ,, 1s. 6d.	=	14	11	4½
,, ,, ,, ¼ = 1/18 ,,	=		16	2½
		2637	15	0½. Ans.

(*b*) Val. of 923 at £2 each = 1846 0 0

,, ,, ,, 10s. = ½ at £2 = 461 10 0

,, ,, ,, 5s. = ¼ ,, 10s. = 230 15 0

,, ,, ,, 10d. = ⅓ ,, 5s. = 38 9 2

,, ,, ,, ½d. = 1/20 ,, 10d. = 19 2½

2577 13 4½. Ans.

∴ (*a*) is greater than (*b*) by (£2637 15s. 0½d. − £2577 13s. 4½d.) = £60 1s. 8d. Ans.

4. If 2 cwt. 1 qr. 17 lbs cost £50 11s. 4d., how much can be brought for £18 7s. 6d.?

£50 11s. 4d. : £18 7s. 6d. :: 2 cwt. 1 qr. 17 lbs. : ?

or 12136d. or 4410d. or 269 lbs.

$\frac{269 \text{ lb} \times 4410}{12136} = \frac{296450}{6067}$ lbs. = 3 qrs. 13 lbs. 11 oz. $15\frac{2859}{6067}$ drs.

FEMALES.

1. Make out the following bill:—

4½ dozen atlases at 12s. 6d. each.
30 dozen copy-books at 6s. per dozen.
8½ dozen copy-books at 3s. 6d. per dozen.
32 grammars at 3s. 6d. each.
12 dozen exercise-books at 2½d. each.
25 engravings at 7s. 6d. each.
28 books binding at 4s. 9d. each.

		s.	d.		£	s.	d.
4½ dozen	at	12	6	each	33	15	0
30 ,,	,,	6	0	per doz. ...	9	0	0
8½ ,,	,,	3	6	,, ...	1	9	9
32 grammars	,,	3	6	each	5	12	0
12 doz. ,,	,,	0	2½	,, ...	1	13	0
25 engravings	,,	7	6	,, ...	9	7	6
28 books	,,	4	9	,, ...	6	13	0
					67	10	3. Ans.

2. Find the cost of six thousand three hundred and eighty-two articles at £40 17s. 7½d. each.

		£	s.	d.
Value of 6382 at £1 each	=	6382	0	0
				40
,, ,, £40	=	255,280	0	0
,, ,, 10s. = ½ val. at £1	=	3,191	0	0
,, ,, 5s. = ½ ,, 10s.	=	1,595	10	0
,, ,, 2s. 6d. = ½ ,, 5s.	=	797	15	0
,, ,, 1½d. = 1/16 ,, 2s. 6d.	=	39	17	9
,, ,, ½d. = ⅓ ,, 1½d.	=	6	12	11½
,, ,, £40 17s. 7¾d.	=	260,910	15	8¼. Ans.

3. What is the value of 500 acres 3 roods 29 poles of land at one hundred guineas seventeen shillings and eightpence per acre?

100 guineas 17s. 8d. = £105 17s. 8d.

		£	s.	d.
Value of 1 ac.	=	105	17	8
				500
,, 500 ac.	=	52,941	13	4
,, 2 ro. = ¼ val. of 1 ac.	=	52	18	10
,, 1 ,, = ½ ,, 2 ro	=	26	9	5
,, 20 po. = ½ ,, 1 ,,	=	13	4	8½
,, 8 ,, = ⅕ ,, 1 ,,	=	5	5	10½ ⅖
,, 1 ,, = ⅛ ,, 8 po.	=	0	13	2¾ 1/10
,, 500 ac. 3 ro. 29 po.	=	53,040	5	4¼ 7/10 far. Ans.

4. Divide £9 11s. 8d. among ten men, six women, and fourteen children, giving a woman three times as much as a child, and a man twice as much as a woman.

14 children get 1 share each = 14 shares.
6 women ,, 3 shares ,, = 18 ,,
10 men ,, 6 ,, ,, = 60 ,,
Total ... ... 92 shares.

£9 11s. 8d. ÷ 92 = 1912d./92 = 2s. 1d. child's share. Ans.
∴ a woman gets 2s. 1d. × 3 = 6s. 3d. woman's ,, Ans.
and a man ,, 6s. 3d. × 2 = 12s. 6d. man's ,, Ans.

Grammar.

1. 'The wild birds told their warbling tale,
And wakened every flower that blows,
And peeped forth the violet pale,
And spread her breath the mountain rose.'

(*a*) Show which are the nouns in the nominative case in the above, and to what verb each is the nominative.

(*b*) Point out all the adjectives in the above, and show what noun each adjective qualifies.

(*a*) The nouns in the nominative case are '*birds*' nom. to '*told*' and '*wakened*'; '*violet*' nom. to '*peeped*'; and '*rose*' nom. to '*spread*.'

(*b*) The adjectives are '*wild*' qual. '*birds*'; '*warbling*' qual. '*tale*'; '*every*' dist. '*flower*'; '*pale*' qual. '*violet*'; and '*mountain*' qual. '*rose*.'

'*Their*' and '*her*' are pronom. poss. adjectives, and '*the*' is often reckoned a distinguishing adjective.

2. In what mood is the verb after the auxiliaries *can*, *must*, *will*, *shall*? Give examples.

The mood after *can*, *must*, *will*, *shall* is the infinitive; as, '*I can* (*to*) *go*'; '*I must* (*to*) *read*'; '*he will* (*to*) *write*'; '*they shall* (*to*) *obey*.'

Geography.

Answer two Questions.

1. Describe minutely the counties of Durham, Caithness, Pembroke, and Kerry.

Durham is a maritime county of England, bounded on the N. by the Tyne and the Derwent, which separate it from Northumberland; on the W. by Cumberland and Westmoreland; on the S. by the Tees, separating it from Yorkshire; and on the E. by the North Sea. The surface is hilly, and slopes from the west towards the coast. The principal rivers are the Wear, Tyne, and Tees. Durham is one of the chief coal and lead counties in England. Iron, and other mineral products are obtained on an important scale. A belt of agricultural land extends along the coast, in the southern part of which salt-mines are found. Iron ship-building is extensively carried on at Sunderland, South Shields, Stockton, and Hartlepool. Various manufactures are carried on, but none to any great extent.

Caithness forms the north-eastern extremity of Britain, having but one land boundary, that on the west, where a ridge of hills running north from Morven and the Ord of Caithness separate it from Sutherland. The greater part of the county is made up of mountainous moorland, surrounded by rugged cliffs. The bleak moors and marshes of the interior are being cultivated by the industry of the people, and now form one of the most fruitful districts in the north of Scotland. There are numerous lakes, and rivers valuable for salmon fishing. The glens and hollows between the mountains afford excellent pasture for cattle and sheep.

Pembroke has but one land boundary, that on the N.E., towards Cardigan and Carmarthen: on all other sides it is surrounded by the sea, and has its shores worn into deep bays and creeks, such as Bride's Bay, and Milford Haven, a harbour large enough to contain the whole of the British fleet. The county forms a peninsula at the south-west corner of Wales. Its scenery is not very rugged, and throughout the whole shire, as the hills near the sea, they sink so low that large tracts of land can be cultivated. The chief towns lie round the inlet of Milford Haven, to which population is drawn by its shipping trade and its ship-building yards.

Kerry lies next to Limerick, on the estuary of the Shannon, and projecting into the Atlantic, forms the most south-western part of Ireland. To the south and east it is bounded by the county of Cork. Its coast is more rugged than any other part of the Irish shores, and is thickly studded with small islands, of which the principal is Valentia. Two peninsulas jut out to the ocean on its western side, between the deep bays worn by the Atlantic waves, the one ending in Mt. Brandon between Bays Tralee and Dingle, and the other formed of the mass of the McGillicuddy's Reeks, between Dingle Bay and Kenmare Bay. The Reeks end on their eastern side in the mountains and lakes of Killarney, well-known for their beautiful scenery. The industry of the county is small, and consists wholly of cattle-grazing, so that it has scarcely any towns, except the fishing-town of Tralee, and Killarney, which depends on the tourists who visit the Lakes.

2. Name the rivers which water the Midland and Eastern Counties of England, and describe their course.

The rivers which water the Midland and Eastern counties are:—

(1) The *Trent*, which rises in the N. of Staffordshire, flows S.E. through Staffordshire, E. through the S. part of Derby, N.E. through Nottingham, N. through Lincoln, and unites with the Yorkshire Ouse in forming the Humber Mouth. It receives the *Sow* from Stafford, the *Derwent* from the N. of Derbyshire, and the *Soar* from Leicester.

(2) The *Great Ouse*, which rises in the S. of Northamptonshire, flows N.E. through Buckingham, Bedford, Huntingdon, and Cambridge, N. through Norfolk, and falls into the wash at Lynn Regis; it receives the *Cam* from Cambridge, and the *Little Ouse* from Norfolk.

(3) The *Witham*, in Lincoln, flows eastwards by a circuitous route into the Wash.

(4) The *Welland*, forming the northern boundary of Northamptonshire, flows eastward into the Wash.

(5) The *Nen*, flowing northwards into the Wash.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible*.

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light*.

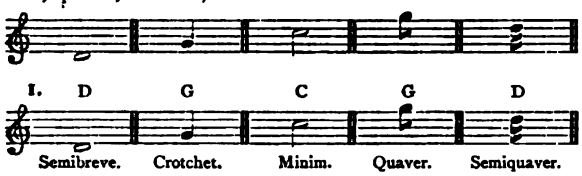
Needlework.

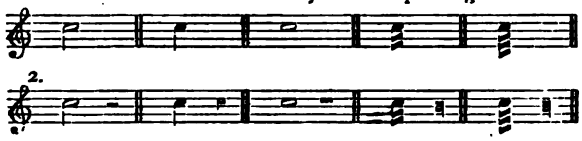
One hour allowed for this Exercise.

Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.

3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a semibreve?

3. If we make *one* beat while we sing a crotchet, we must make *four* while we sing a semibreve—a semibreve being equal to four crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Take from $1056\frac{3}{5}$ the sum of following numbers: $84\frac{1}{2}$, $56\frac{3}{16}$, and $195\frac{3}{8}$, and add $278\frac{3}{4}$ to the result. (Be careful not to use unnecessary figures.)

$$\{1056\tfrac{3}{5} - (84\tfrac{1}{2} + 56\tfrac{3}{16} + 195\tfrac{3}{8})\} + 278\tfrac{3}{4} =$$
$$\{1056\tfrac{3}{5} - 335\tfrac{13}{16}\} + 278\tfrac{3}{4} =$$
$$720\tfrac{11}{16} + 278\tfrac{12}{16} = 999\tfrac{23}{16}. \text{ Ans.}$$

2. Find the difference between $19\frac{1}{8} \times \frac{3}{16}$; and $2\frac{1}{8} \times 3\frac{1}{19}$.

$$2\tfrac{1}{8} \times 3\tfrac{1}{19} = \frac{17 \times 72}{8 \times 19} = \frac{153}{19} = 8\tfrac{1}{19} = 8\tfrac{152}{2432}$$
$$19\tfrac{3}{8} \times \tfrac{3}{16} = \frac{157 \times 3}{8 \times 16} = \frac{471}{128} = 3\tfrac{87}{128} = 3\tfrac{1824}{2432}$$
The difference is $4\frac{907}{2432}$. Ans.

3. Express the height of a mountain 4 miles 7 furlongs high as a fraction of the earth's diameter, which is 7,926 miles.

$$\frac{4 \text{ mls. } 7 \text{ fur.}}{7{,}926 \text{ mls.}} = \frac{39}{63408} = \frac{13}{21136} \text{ Ans.}$$

4. A French metre equals 39·371 English inches. Express in terms of a metre 3 miles 7 furlongs 12 poles; 5 miles 1250 yards; 17 miles 3 furlongs 2 yards 15 inches; and 7·2854 furlongs.

(*a*) $\frac{3 \text{ mls. } 7 \text{ fur } 12 \text{ po.}}{39{\cdot}371 \text{ in.}} = \frac{247896 \text{ in.}}{39{\cdot}371} = 6296{\cdot}4$ metres.

(*b*) $\frac{5 \text{ mls. } 1250 \text{ yds.}}{39{\cdot}371 \text{ in.}} = \frac{361800 \text{ in.}}{39{\cdot}371} = 9109{\cdot}5$,,

(*c*) $\frac{17 \text{ mls. } 3 \text{ fur. } 2 \text{ yds. } 15 \text{ in.}}{39{\cdot}371} = \frac{1100967 \text{ in.}}{39{\cdot}371} = 27963{\cdot}9$ mets.

(*d*) $\frac{7{\cdot}2854 \text{ fur.}}{39{\cdot}371 \text{ in.}} = \frac{57700{\cdot}368 \text{ in.}}{39{\cdot}371} = 1465{\cdot}5$ metres.

FEMALES.

1. A bankrupt fails to the amount of £2,500; what are his effects worth if he pays 7s. 9d. in the pound? And how much will one of his creditors lose to whom he owes £600 12s. 6d.?

(*a*) His effects = £2500 at 7s. 9d. each.

		£	s.	d.
£2500 @ £1 each	=	2500	0	0
,, @ 5s. ,, = ¼ at £1	=	625	0	0
,, @ 2s. 6d. ,, = ½ at 5s.	=	312	10	0
,, @ 3d. ,, = $\frac{1}{10}$ at 2s. 6d.	=	31	5	0
∴ his effects =		968	15	0 Ans.

(*b*) Loss per £ to each creditor = 12s. 3d.

		£	s.	d.
Loss on £600 12s. 6d. at £1 per £ ...	=	600	12	6
,, ,, ,, 10s. ,, = ½ at £1	=	300	6	3
,, ,, ,, 2s. ,, = ⅕ at 10s.	=	60	1	3
,, ,, ,, 3d. ,, = ⅛ at 2s.	=	7	10	$1\frac{7}{8}$
Total loss =		367	17	$7\frac{7}{8}$ Ans.

2. A besieged town, containing 5,000 people, has provisions for thirty days, at the rate of 12 ozs. for each person per day. Suppose a quarter of the population leave the town, and each person left is allowed 15 ozs. per day, determine the time the provisions will now last.

$$\left.\begin{matrix} 15 \text{ ozs.} : 12 \text{ ozs.} \\ 3 : 4 \end{matrix}\right\} :: 30 \text{ days} : \text{time required.}$$
$$\frac{30 \text{ days} \times 12 \times 4}{15 \times 3} = 32 \text{ days. Ans.}$$

3. If three boxes of oranges, each containing 2,060, cost £5 19s. 6d., what will seventeen boxes cost, each containing half as many again as the former?

$$\left.\begin{matrix} 3 \text{ boxes} : 17 \text{ boxes} \\ 2 \text{ oranges} : 3 \text{ oranges} \end{matrix}\right\} :: £5\ 19\text{s. } 6\text{d.} : \text{Cost}$$
$$\frac{£5\ 19\text{s. } 6\text{d.} \times 17 \times 3}{3 \times 2} = \frac{£101\ 11\text{s. } 6\text{d.}}{2} = £50\ 15\text{s. } 9\text{d. Ans.}$$

Note.—The ratio of oranges in each box = 2 : 3.

4. What is the purchase money of 4 hhds. of sugar, each weighing 2 cwt. 3 qrs. 17 lbs., if 3 qrs. 16 lbs. cost £1 13s. 4d.?

3 qrs. 16 lbs. : 2 cwt. 3 qrs. 17 lbs. × 4 :: £1 13s. 4d. : ?
or or
100 lbs. 1300 lbs.
$$\frac{£1\ 13\text{s. } 4\text{d.} \times 1300}{100} = £21\ 13\text{s. } 4\text{d. Ans.}$$

Grammar.

1. 'Flow softly down by lawn and lea,
A rivulet, then a river;
No where by thee my steps shall be
For ever and for ever.'—TENNYSON.

Parse all the adverbs and pronouns in the above.

softly, adv. of manner, mod. '*flow*.'
down, ,, place, ,, ,,
then, ,, time ,, (*flowing?*)
no where, ,, place ,, '*shall be*.'
thee, pers. pron., 2nd pers., sing., standing for 'rivulet' personified, object, gov. by '*by*.'
my, pronoun, poss. adj. or poss. case of 1st pers. pron. attributive to '*steps*.'
for ever, adv. phrase of time mod. '*shall be*.'

2. Distinguish between simple prepositions, compound prepositions, and phrase prepositions, and give one or two examples of each.

Simple prepositions consist of a *single word*, as, *in*, *to*, *of*, *for*; *compound prepositions* are compounded of one another, as, *in-to*, *up-on*, *with-out*, *through-out*, *with-in*; and *phrase prepositions* are phrases of two or more words, having together the exact force of a preposition, as '*in the midst of*,' '*right through*,' '*at the moment of*,' '*in place of*.'

3. The word 'what' is used sometimes as a relative, sometimes as a direct interrogative, sometimes as an indirect interrogative pronoun. Give examples of each use.

(*a*) '*What*' is a relative, as '*I understand what you say.*'
(*b*) '*What*' is a direct interrogative, as '*What do you say?*'
(*c*) '*What*' is an indirect interrogative pronoun, as '*Tell me what he said.*'

In (*a*) the antecedent to 'what' is suppressed, 'what' introducing a subordinate adjective sentence. In (*c*) the dependent clause is a *substantive* clause having no antecedent expressed or understood to which it relates. It is based upon the direct question, '*What did he say?*'

Geography.

Answer either No. 2 or No. 3, not both.

1. Draw a full map of Italy, with the adjacent islands. Insert the lines of latitude and longitude.

2. Give notes of a lesson on 'The Rivers of Russia flowing southward,' and show how the nature of the country affects their courses.

I. Sketch on blackboard the outline of Russia showing the Valdai Hills. Explain water-shed to be the line or division separating one river-system or basin from another—sometimes very well defined as the Alps, dividing the rivers of Northern Italy from those of Switzerland—but in Russia on account of the general flatness of the country the watershed is not formed by mountains, but by tracts of gently-rising ground. Taking the knuckle of land a little to the West of Moscow we have three lines of watershed—*one* running from the Moskwa N. E. to the Urals, separating the rivers which flow into the Caspian from those which flow into the White Sea, and containing the sources of the Volga and other large rivers. *Another* beginning near the same point extends S. E., dividing the Volga from the rivers which run southward and unite with the Dnieper and the Don. The *third* extends westward to the Bug, and forms an almost continuous swamp, in which many affluents of the Vistula, Dnieper, and Don take their rise. As Russia is essentially a level country, the rivers present a greater line of inland navigation than those of most other countries.

II. Sketch the courses of (1) the Volga (with its tributaries the Oka and Kama), flowing into the Caspian Sea; (2) the Don into the Sea of Azov; (3) The Dnieper, (4) the Dniester, and (5) the Bug, flowing into the Black Sea.

3. Write a letter as from an Englishman in Spain, describing what he had seen in that country that was new to him, and unlike anything in England.

Madrid, July 29, 1882.

SIR,—Having reached the capital of Spain, after a general survey of the country and its people, I shall give you a few of those peculiarities which I considered most striking.

There is no country of Europe except Switzerland which possesses such an extent of mountainous surface as Spain. The Pyrenees, like a huge rampart, stretch along the northern border so unbroken that there are only two passes that allow the passage of wheeled vehicles. There are many shallower passes, seemingly cut in the rocks, only fit for mules and foot-travellers. Four other chains run parallel to the Pyrenees, called Sierras, from the *saw-like* appearance of their summits.

The interior of the country consists of a series of plateaux or terraces, separated by these lofty sierras, the higher peaks of which are covered with snow. On the borders, however, Spain resembles many countries of Europe, for the exposure of its north coast to the Bay of Biscay gives it an English character, while the southern end partakes of an African character; and here the produce consists of date-palms, bananas, and sugar-canes. The central parts favour the growth of the vine. Although the country is not famed for large quantities of timber, the mountain-sides are in some districts clothed with trees, notably, the *cork-oak*, which produces the thick bark, that constitutes the cork of commerce. The roads of the country are so bad that in the south crops of wheat have been utterly wasted for want of good carriage-way to transport them to the sea.

Among its animals, mention must be made of the *merino* sheep, whose fleece is so fine and highly prized, and the Andalusian bull, in demand for the bull-fights which form the national sport, corresponding to horse-racing in England. Mules and asses are very much finer than any seen in England and are as commonly used as horses are in our country.

The tunny, a fish caught for its oil and for food; the sardine, which goes to England preserved in oil; and the anchovy are fished in the Mediterranean.

Millions of hives store the honey gathered from the flowers of every part of the country. Silkworms are reared for their cocoons, and the cochineal insect for its dye.

The bear, wolf, lynx, and wild boar are found in various retired parts, and a species of monkey is seen at Gibraltar.

At Almaden is one of the richest quicksilver mines in the world, and in Galicia is found a supply of cobalt almost equal to the demand of all Europe, and exhaustless mines of rock-salt are met with in Catalonia.

Wine is the great national manufacture, of which Xeres is the centre, and gives name to the principal export, *sherry*.

The country, as was said above, is badly off for roads, which prevents the progress of inland traffic, but the introduction and spread of the railway system will reduce this evil.

A traveller, new from the verdure of England, is astonished and horrified at the treeless aspect of the country. The Spaniards seem to have an innate hatred to trees, and if they do not cut them for firewood, they cut them down because they afford a harbour for sparrows that eat the grain.

The finest people of Spain are found in Andalusia, who are tall and handsome, and look well in their picturesque costume when they congregate to show off their finery, and smoke their paper cigars in the squares of the towns.

I should have noted that agriculture is everywhere in a very backward state, the implements being of the rudest description. Of the noxious winds that exceed even the most rigorous of English east winds, are the *Solano*, a hot wind from the south, and the *Gallego*, a cold, piercing one from the N.W.

I am, Sir,
To ——— Esq. } Your obedient servant,
H. M. Inspector of Schools. } PUPIL TEACHER.

History.

1. Give the names and dates of our sovereigns from Egbert to Edward the Elder.

	A.D.
Egbert became King of England	827
Ethelwolf ,, ,,	836
Ethelbald ,, ,,	858
Ethelbert ,, ,,	858
Ethelred ,, ,,	866
Alfred ,, ,,	871
Edward the Elder ,, ,,	901

2. What sovereigns ascended the throne in 1135, 1377, 1422, and 1509? Name their immediate successors.

Stephen ascended the throne 1135; was succeeded by Henry II.
Richard II. ,, ,, 1377; ,, ,, Henry IV.
Henry VI. ,, ,, 1422; ,, ,, Edward IV.
Henry VIII. ,, ,, 1509; ,, ,, Edward VI.

3. Write down a list of our sovereigns from 1685 to 1760.

James II. began to reign	1685 (deposed 1688)
William III. and Mary II.	,, 1689
Anne	,, 1702
George I.	,, 1714
George II.	,, 1727
George III.	,, 1760

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

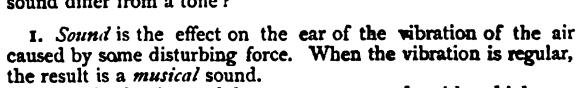
A quarter of an hour allowed for this Paper.

1. What is meant by *sound*, what by a *tone*; and how does a sound differ from a tone?

1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular, the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (F) *Fa*, (B♭) *Se*, and (C) *Do*.



2. A *triad* is the addition of its *third* and *fifth* to any given note.

3. How many tones and how many semitones are found in the diatonic major scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. How much stock, at 91½, can be bought for £768; the broker's commission being ¼ per cent.?

£91½ + ¼ : £768 :: £100 : stock

$$£\frac{100 \times 768 \times 4}{365} = £\frac{821{,}491{,}200}{73} = \underline{£841\ 12s.\ 7\tfrac{7}{73}d.}\quad \text{Ans.}$$

2. In 1831, the population of England and Wales was 13,896,797; in 1841, it was 15,914,148; in 1851, it was 17,927,609; in 1861, 20,066,224; and in 1871, 22,782,266. What was the ratio of increase per cent. during each interval of ten years?

Increase per cent. from 1831 till 1841 $= \frac{2017351 \times 100}{13896797} = \underline{14{\cdot}51}$

,, ,, ,, ,, 1841 ,, 1851 $= \frac{2013461 \times 100}{15914148} = \underline{12{\cdot}65}$

,, ,, ,, ,, 1851 ,, 1861 $= \frac{2138615 \times 100}{17927609} = \underline{11{\cdot}93}$

,, ,, ,, ,, 1861 ,, 1871 $= \frac{2716042 \times 100}{20066224} = \underline{13{\cdot}53}$

3. If a grocer mixes 17 lbs. of tea worth 4s per lb., with 25 lbs. worth 4s. 8d. per lb., and sells the whole at 5s. 4d. per lb., what is his total gain, and what is his profit per cent.?

		s.	d.	s.	d.
(*a*)	17 lbs. at	4	0 =	68	0
	25 ,, ,,	4	8 =	116	4
	Cost price		=	184	4
	42 lbs. at	5	4 =	224	0
	Total gain		=	40	8 = £2 0s. 8d.

(*b*) 184½ : 40⅔ :: 100 : gain per cent.

$$\frac{100 \times 122}{553} = \underline{22\tfrac{444}{553}}\%.\quad \text{Ans.}$$

4. What sum put out at simple interest, at 4¾ per cent., will amount to £1310 14s. in six years?

Amount of £100 for 6 years at 4¾ per cent. = £128½

∴ £128½ : £100 :: £1310 14s. : sum required

$$\frac{£1310\ 14s. \times 100 \times 2}{257} = \underline{£1020.}\quad \text{Ans.}$$

FEMALES.

1. Simplify:—

(*a*) 17⅜ + ⅛ of 7⅝.

(*b*) ½ + ⅜ + 5/11 + 7/13 + 17/33.

(*a*) $17\tfrac{3}{8} + \tfrac{1}{8}\text{ of }7\tfrac{5}{6} = 17\tfrac{3}{8} + \frac{4 \times 47}{5 \times 6} = 17\tfrac{13}{15} + 6\tfrac{4}{15} = \underline{23\tfrac{14}{15}}.$ Ans.

(*b*) $\tfrac{1}{2} + \tfrac{3}{8} + \tfrac{5}{11} + \tfrac{7}{13} + \tfrac{17}{33} = \frac{99 + 44 + 54 + 77 + 102}{198}$

$= \tfrac{376}{198} = 1\tfrac{89}{99}$

2. If 30 horses eat 25⅘ bushels of oats in 6 days, how much will one horse eat in a week?

30 horses : 1 horse
6 days : 7 days
:: 25⅘ bushels : ?

$$\frac{180 \text{ bushels} \times 1 \times 7}{7 \times 30 \times 6} = \underline{1 \text{ bushel.}}\quad \text{Ans.}$$

3. A man, after spending ⅔ of his money, and then ¼ of the remainder, and then ⅓ of what then remained, had £25 left; how much had he at first?

Otherwise ⅔ of ¼ of ⅓ of the whole money = £25

that is $\frac{3 \times 2 \times 1}{4 \times 3 \times 2}$,, ,, = £25

,, 1/4 ,, ,, = £25

∴ the whole money = £100. Ans.

4. Divide £120 7s. 10½d. by 8⅞, and multiply the result by 4⅘.

£	s.	d.		£	s.	d.	
120	7	10½					
		9					
79)1083	10	8½ (		13	14	3⅔	Quotient
79						4⅘	
293				9)109	14	6	
237				12	3	10	
56				54	17	3	
20				67	1	1	Ans.
1130							
79							
340							
316							
24							
12							
296							
237							
59							
4							
237							
237							

Grammar.

1. What conjunctions are used in asking indirect questions, and what mood is generally used after such conjunctions? Illustrate your answer by examples.

The conjunctions used in asking indirect questions are *whether, if, unless, although, except;* as, '*Do you know whether he will come?*' '*Inform me if you can.*' '*Except he confess I shall not pardon him.*'

2. 'Take warning! he that will not sing
While yon sun prospers in the blue,
Shall sing for want, ere leaves are new,
Caught in the frozen palms of spring.'—TENNYSON.

(*a*) Analyse the above passage from '*Take warning!*' .. to .. '*want.*'

(*b*) Give the meaning in plain simple words of your own.

(*c*) Parse all the verbs in the above.

(*a*)

Sentence.	Kind.	Subject.	Predicate.	Object.	Extensions.
(1) Take warning	Principal	(*thou*)	take	warning	—
(2) he shall sing for want	Principal	he	shall sing	—	for want (*reason*)
(3) that will not sing	adjective to (2)	that	will not sing	—	—
(4) while yon sun prospers in the blue.	adverbial to (3) (*time*)	(while) yon sun	prospers	—	in the blue (*place*)

(*b*) I advise you to make the most of the sunny time of summer, and sing to me in order that you may not feel the sharp edge of hunger before the buds open, and before you are driven to despair by the cold frosty days of early spring.

(*c*) *Take*—irreg. trans. verb, *take, took, taken,* imper. 2nd pers. sing. agr. with (*thou*).

will sing—irreg. intrans. verb, *sing, sang, sung,* indic. future indef. 3rd pers. sing. agr. with '*he.*'

prospers—reg. intrans. verb, indic. pres. indef. 3rd pers. sing. agr. with '*sun.*'

shall—irreg. defec. verb, *shall, should*, indic. pres. indef. 3rd pers. sing. agr. with '*he.*'
sing—irreg. intrans. verb, *sing, sang, sung*, infin. pres. indef., gov. by '*shall.*'
are—irreg. intrans. verb, *am, was, been*, indic. pres. indef., 3rd pers. plur. agr. with '*leaves.*'
caught—irreg. trans. verb, *catch, caught, caught*, complete part. attrib. to '*he.*'

Geography.

Answer No. 2 or No. 3; not both.

1. Give notes of a lesson on 'The British Settlements in Australia,' and illustrate it by sketch-maps, showing the position of each settlement. Insert the lines of latitude and longitude.

NOTES OF LESSON ON AUSTRALIA.

(*a*) *Position.*—Between 10° 40′ and 39° 12′ S. lat., and between 113° and 153° 39′ E. long. *Shape.*—Trapezoidal or of an irregular onion form. *Size*, 2500 miles from E. to W. 1970 miles from N. to S.; area about 3,000,000 square miles, or ¼ less than Europe.

(*b*) British settlements and chief towns:—

New South Wales,	.	Sydney, Newcastle, Bathurst.
Victoria,	. . .	Melbourne. Geelong, Ballarat.
S. Australia,	. .	Adelaide, Kooringa.
W. Australia,	. .	Perth, Freemantle.
Queensland,	. .	Brisbane, Ipswich, Rockhampton.

(*c*) *New South Wales*—so named by Cook—founded 1788—a penal settlement at first—ceased to be such in 1840—new life given to colony after discovery of gold 1851. *Victoria*—settled 1835—first called Australia Felix—colonists came from Tasmania—discovery of gold caused a great influx of adventurers—soon became the foremost of Australian colonies. *S. Australia*—proclaimed a colony 1839—suffered much from over speculation—assisted by Home Government—discovery of copper mines at Burra-Burra hastened its prosperity. *W. Australia*—settled 1829—first called Swan River Settlement—from various causes has not been so prosperous as the other colonies. *Queensland*—proclaimed a colony 1859—formerly part of New South Wales, and called Moreton Bay Settlement.

(*d*) The mountain ranges of Australia are all on or near the coast, and this fact combined with the impassable character of these chains, and the uninviting nature of the interior, caused the settlements to be founded along the sea-board, where there are many rivers and general fertility.

(*e*) Its seasons the reverse of ours—being nearer the equator than Great Britain, its temperature is much higher—monsoons blow in the northern half—westerly winds prevail in south—speaking generally the settled districts are dry and healthy—in New South Wales, Victoria, and S. Australia, these three peculiarities may be noted: (1) *long droughts*, very destructive; (2) hot *winds*, blowing from the interior; (3) sudden transition from heat to cold. *Productions.*—Gold, copper, wool, tallow—land better suited for pasture than tillage—vegetation goes on all the year, and is peculiar, consisting chiefly of gum trees, acacias, and heaths—food plants of Europe have been introduced—native animals nearly all pouched (*e.g.* Kangaroo)—remarkable birds are lyre-bird, emu, and black swan.

2. Trace the course of a ship from London to Bombay by the Suez Canal, describing minutely each British dependency you pass.

Leaving London, the metropolis of the British Empire, we sail eastwards to the mouth of the Thames, turn southwards through the Strait of Dover and the Downs, and enter the English Channel. Off the coast of France, and geographically connected with it, lie the Channel Islands, the oldest foreign possession of the British Crown, being all that is now left of the territory brought by William I. They consist of Jersey, Guernsey, Alderney, and Sark, but as they are more a part of Britain than a dependency they need not be described here. Proceeding down through the Bay of Biscay, and passing the coast of Portugal and Spain, we turn eastward to Gibraltar, the 'Key of the Mediterranean.' Gibraltar Rock is a mass of gray stone about three miles long, from north to south, and nearly a mile broad. It is connected with the mainland by an isthmus, and ends in the south in Europa Point. The rock rises more than a 1000 ft. in some places, is inaccessible on the north and east, and nearly so on the south. On the west where it slopes down to Gibraltar Bay it is protected by batteries, and the whole is so defended that it is considered impregnable. The town of Gibraltar fronts the Bay on the north-west; Gibraltar has belonged to Britain since 1704. Proceeding on our voyage we continue east till we arrive at Malta and the adjacent islands of Comino and Gozo. Gozo, the most northerly of the three has a rich soil and a famous Giant Tower. Comino is a small island between the two. Malta, the largest and most important is half the size of the Isle of Wight, with a mild and healthy climate. It produces cotton, grain, and fruits. The group has a population of 152,000. Valetta, the capital, is strongly fortified, and a central station for British ships. Our route still continues east to Alexandria and Port Said, where we enter the Suez Canal, which is so important to Britain as a short passage to India, that she has gone to war to protect it. Passing down the canal we reach Suez and enter the Red Sea, leaving which by the Straits of Babelmandeb we arrive at Aden, situated at the south-west corner of Arabia, about 100 miles from the entrance to the Red Sea. This place is used as a depot for the supply of coal to the steamers running on such a voyage as this. It is also an important military station, being near the entrance to the Red Sea. In the middle of the Strait of Babelmandeb is the island of Perim, which was occupied by the British for the purpose of building a lighthouse upon it. Proceeding across the Arabian Sea, we arrive at our destination, Bombay.

3. Write a letter as from an Englishman in Spain, describing the things he has seen in that country that were new to him and unlike anything in England.

(See this question answered under First Year).

SECOND PAPER.

Two hours and a half allowed.

History.

1. What roads did the Romans make in Britain? With what object, and with what effect on the country?

Four great roads crossed the country between distant and important points: these were *Watling Street*, from Rutupiæ (Richborough) in Kent by London to Carnarvon; *Ikenild Street*, from Tynemouth by York, and through the Midlands to St. David's; *Irmin Street*, from St. David's to Southampton; and the *Foss*, from Cornwall through Exeter to Lincoln. These were great military roads, which enabled the Romans to strike at any insurrection of the people, as well as protect the island from aggressors. By their means, too, they opened up the island and developed the resources.

2. Give the date and circumstances of the death of William I. Who succeeded to his dominions? Was it for the interest of the nobles and the people of this country that they should be divided or kept under one ruler?

The French king having insulted William, the latter declared war, and during the siege of Mantes, the English king rode out to view the burning town. The plunging of his horse, which trod on some hot embers, bruised him severely against the pommel of the saddle. The bruise inflamed, and after six weeks he died at Rouen (1087).

His son William succeeded him, and it was to the interest of the nobles and people to be united under one ruler, for under two rulers the country would never be at rest. The union of the nobles and the people prevented the tyrannous kings from invading the privileges of either. If the nobles had chosen Robert, and the people William, the nobles would have fared badly as they were very much in the minority, and unable to cope with the common people.

3. Who was Henry III.? At what date did he ascend the throne, and what event of first importance to the liberties of the people happened in his reign?

Henry III., son of King John, ascended the throne 1216, when only ten years of age.

In his reign, 1265, the Earl of Leicester called a parliament, to which he summoned representatives from cities and boroughs, in addition to the prelates, barons, and knights of the shire. This was the first outline of our modern Parliament; the prelates and barons corresponding to the House of Lords, the others to the House of Commons, which, accordingly, dates from this time.

Composition.

Write full notes of a lesson on *The Army.*

Introduction.—If drill is taught, begin by asking the use of it—draw from the children what they have heard about volunteers—militiamen—regular soldiers—describe, or get from children the meaning of uniform—why so called—some of them may have relations among the volunteers—or among the militia—or *in the army.*

THE ARMY.—Difference between the army and the volunteers—how the men are enlisted—Queen's shilling—recruit—swearing in—feelings of the new soldier—parting from home, etc.—*barracks* described—life of the soldier—care taken of him—school in the barracks—books for reading—savings from wages put in bank—sleeping rooms described—soldier makes his own bed—cleans his arms—what are his arms?—parade—examination by the officer—punishments—the march out—the band—and the drummer-boys—anecdotes or stories about drummer-boy.

PARTS OF THE ARMY.—*Infantry*—squad—company—battalion—regiment—brigade—division. *Cavalry*—troop—squadron. *Artillery.—Engineers.*—the duties of these.

RANKS IN THE ARMY.—Private—corporal—sergeant—lieutenant—captain—major—colonel—general—field-marshal—ask for names of celebrated soldiers.

USE OF THE ARMY.—Protection at home and abroad—keep out enemies and defend our foreign possessions—explain garrison duty—foreign stations—foreign service. Refer to the war in Egypt, and give some account of the transport of the troops—and explain why the war is undertaken—the use of the Suez Canal for the short passage of soldiers to India in case of war there. Ask names of celebrated battles.

N.B.—*The difficult and novel words in the above lesson to be carefully written on black-board, and copied by the children for spelling and meaning.*

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. From a given point, to draw a straight line equal to a given straight line.

Prop. 2, Bk. I.

2. The middle point of the base of an isosceles triangle is joined to the vertex; show that the triangles so formed are equal in all respects. (Apply proposition 5, then 4).

Because ABC is isosceles, by prop. 5 the angles at B and C are equal; and by hypothesis BD = DC, and AB = AC. ∴ By prop. 4 the triangles ABD, ACD are equal in every respect. Q. E. D.

3. If at a point in a straight line, two other straight lines, upon the opposite sides of it, make the adjacent angles together equal to two right angles; then these two straight lines shall be in one and the same straight line.

Prop. 14, Bk. I.

Needlework.

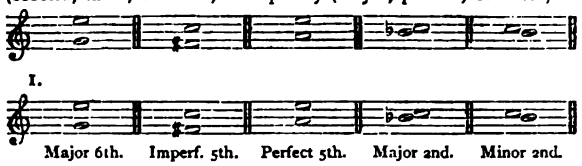
FEMALES.

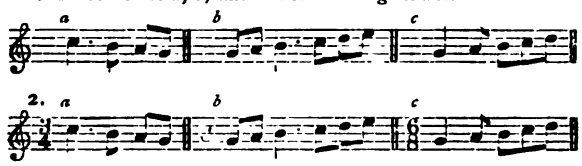
One hour allowed for this Exercise.

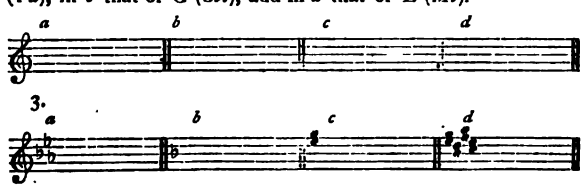
Music.

A quarter of an hour allowed for this Paper.

1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).



2. Place before *a*, *b*, and *c* their time signatures.

3. Write in *a* the scale signature of E♭ (*Mi*), in *b* that of F (*Fa*), in *c* that of G (*Sol*), and in *d* that of E (*Mi*).



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. What is the compound interest on £1150 for 2½ years at 5 per cent?

5 per cent. interest = $\frac{1}{20}$ of principal to be added for every year.
,, ,, = $\frac{1}{40}$,, ,, half year.

$\frac{1}{40}$ of	1150	0	0	
	57	10	0	
$\frac{1}{20}$ of	1207	10	0	= amt. at end of year.
	60	7	6	
$\frac{1}{20}$ of	1267	17	6	= ,, ,, 2nd year.
	31	13	11½	
	1299	11	5½	= ,, ,, 2½ years.
deduct	1150	0	0	
	149	11	5½	= comp. int. for 2½ years. Ans.

2. Give an easy rule for reducing English money to a decimal form up to 3 places, and say what advantage there is in working sums in interest by decimals, and what chance there is of error in employing this method. Apply your rule to the reduction of £767 14s. 6½d. to decimals, and to the conversion of £15·468 to ordinary money.

Rule.—Take the pounds as whole numbers and fill up to three places of decimals as follows:—100 *for every* 2 *shillings,* 50 *for a shilling,* 25 *for* 6 *pence and* 1 *for every additional farthing.*

In working sums in interest by this method we have the advantage of multiplying a simple multiplication sum, whereas by keeping the denominations £ s. d. we have the laborious work of compound multiplication. As the farthing in the above rule is reckoned ·001 of £1 instead of $\frac{1}{960}$ of £1 without very serious error, yet in cases where the decimal expression has to be multiplied considerably it is better to follow the rule above

as 'ar as sixpence; *but for every penny above an even sixpence place* 416 *in the third and following places, and for every odd farthing place* 10416 *in the third and following places as far as required.*

	(*a*)		(*b*)
£767 =	767·000	£15 =	15 0 0
14s. =	·700	·4 =	0 8 0
6d. =	·025	·05 =	0 1 0
¾d. =	·003	·018 =	0 0 4½
	767·728 Ans.		£15 9 4½ Ans.

Rule for working (*b*), *Take two shillings for every* 1 *in the first decimal place, one shilling for every* 5 *in the second and a farthing for each of the remaining figures to the third place.*

3. Reduce 2746 American dollars 30 cents. to English money, assuming the dollar to be worth 4s. 3½d. of our money in exchange.

	£	s.	d.
2746·3 @ £1 =	2746	6	0
4s. = ⅕ of £1 =	549	5	2⅘
3d. = 1/20 of 4s. =	34	6	6 9/20
¼d. = ⅛ of 3d. =	5	14	5 3/10
	589	6	2 9/10 Ans.

4. If two trains meet, the one 150 yards long, moving at the rate of 50 miles an hour, and the other 240 yards long, at the rate of 40 miles an hour; how long will they be in passing one another?

The two trains pass one another with a velocity equal to the sum of their rates per hour, that is, 90 miles, and the question simplified is: *How long will it take a train going at the rate of* 90 *miles an hour to run* 390 *yds?*

90 mls. : 390 yds. :: 1 hr. : time required.

$$\frac{3600 \text{ sec.} \times 390}{90 \times 1760} = \frac{1404}{176} = 8\tfrac{12}{22} \text{ sec.} \quad \text{Ans.}$$

FEMALES.

1. Express as vulgar fractions in their lowest terms:—

·4, ·036, 2·05, 500·0709, and 53·0000100.

·4 = 4/10	= 2/5
·036 = 36/1000	= 9/250
2·05 = 205/100	= 2 1/20
500·0709	= 500 709/10000
53·0000100	= 53 1/100000

2. Find the continued product of 2·03 × 203 × ·00203 × 20300. Prove the truth of the result by fractions.

(*a*)

2·03
2 03
6 09
406
412·09
·002 03
1236 27
82418
·83654 27
203 00
25096281 00
16730854
16981·81681 Ans.

Proof.

(*b*) $\frac{203}{100} \times \frac{203}{1} \times \frac{203}{100000} \times \frac{20300}{1} =$

$$\frac{203 \times 203 \times 203 \times 20300}{100 \times 100000} = \frac{1698181681}{100000}$$

$$= 16981\tfrac{81681}{100000}$$

3. A man who owns ⅞ of a farm sells 4/11 of his share, what decimal part of the farm does he still own?

After selling 4/11 he has 7/11 left.

$$\frac{7}{11} \text{ of } \frac{7}{8} = \frac{49}{88} = \frac{6{\cdot}125}{11} = {\cdot}5568\dot{1}$$

4. A tradesman having charged ·875 of a crown too much in his bill gave in change 12·4375s.; what was the amount of change he ought to have given?

Amount of proper change = 12·4375s. + ·875 of 5s.
= 12s. 5½d. + 4s. 4½d.
= 16s. 9¾d. Ans.

Grammar.

1. Analyse the following passage, and parse each word:—

'Sweet it is to have done the thing one ought
When fallen in darker days.'—TENNYSON.

Sentence.	Kind of Sentence.	Subject.	Predicate.		Object.	Extension.
			Verb.	Completion		
(1) Sweet it is to have done the thing	Principal	it	is	sweet to have done the thing		
(2) (*Which*) one ought (*to have done*)	Adjective to (1)	one	ought	(*to have done*)	(*which*)	
(3) When (*one* has) fallen in darker days.	adverbial to (1)	(when) (*one*)	has fallen			in darker days. (*time*)

Sweet—adj. predicative of it.
it—pers. pron. 3rd pers. neut, sing. nom. to '*is*.'
is—irreg. intrans. verb, *am, was, been*, indic. pres. indef., 3rd pers. sing., agr. with '*it*.'
to have done—irreg, trans. verb, *do, did, done*, gerundial infin., perfect indef., in apposition with '*it*.'
the—def. art. or dist. adj., limiting '*thing*.'
thing—com. noun, neut., sing., obj., gov. by '*to have done*.
one—indef. pron., 3rd pers. sing., com. nom. to '*ought*.'
ought—i reg. de'ec. verb, (originally past tense of 'owe.' now either pres. or past, according to the tense with which it is joined), indic. past indef. because joined with (*to have don*) 3rd pers. sing., agr. with '*one*.'
When—adverbial conjunction, modif. 'fallen' and introducing a subord. adverb. sent.
fallen—irreg. intrans. verb, *fall, fell, fallen*, complete part. attrib. to '*one*.'
in—prep. gov. obj. case '*days*,' which it relates to '*fallen*.'
darker—adj. compar. deg., qual. '*days*.'
days—abstr. noun, neut. plur. obj., gov. by '*in*.'

2. Make a sentence which shall contain both an enlargement of the subject and an extension of the predicate. Mark which you mean for each.

The examination *which is now proceeding* (enlarg. of subject) is being held *on the 29th day of July* (extension of predicate).

3. Paraphrase the following:—

'O son! thou hast not true humility—
The highest virtue, mother of them all.'—TENNYSON.

My child, you do not possess that lowliness of self-estimation which is the origin of all the best qualities in man. Moore has well written—

'*Humility* that low sweet root
From which all heavenly virtues shoot.'

4. What is the Latin preposition that means across? Give examples of its use in the composition of words.

The Latin preposition that means 'across' is *trans* (*tra-tres*), *trans*pose, *tra*duce, *tres*pass.

Geography.

Answer No. 2 *or No.* 3; *not both.*

1. Give notes of a lesson on the Nile; and illustrate it by a full map. Insert the lines of latitude and longitude.

Method.—Sketch on Black-board the course of the river as lesson proceeds.

SOURCE AND COURSE.—Has its chief source in the Victoria N'yanza (discovered by Baker and Speke) near the equator—runs for 3000 miles—passes through the Albert N'yanza—traverses a level region to Gondokoro—flows with many windings first N. W. then N.E., receives the Bahr-el-gazal (*sketch in*)—turns east—then south—and receives from the east, the Sóbat (*sketch in*)—strikes north—is joined by the Bahr-el-Azrek (*sketch in*)

from Abyssinia, continues north—is joined by the Atbara (*sketch*), under the name of the Takazze—winds through Nubia—enters Egypt at Assouan—at Cairo it begins to form the Delta, that is, an equilateral triangle, the corners of which are at Cairo, at Rosetta, and at Damietta.

Delta.—Surface nearly equal in area to Holland and Belgium—this vast plain produces cotton and wheat—on the banks of the canals and of the branches of the river are built towns and villages—the most important towns being Damanhour, Mansourah, Tantah, Zagazig, by the side of which passes the sweet-water canal, beginning at Ismailia, and ending at Suez. (*Speak of this in connection with present war in Egypt, and draw from the children what they may have heard or read about Egypt in the papers.*)

Use of the Nile.—Fertility of Egypt due entirely to the mud brought down by the annual inundation which begins about the end of June, continues to rise during July and August, and attains its greatest height in September—inundation due to heavy rains in the highlands of Abyssinia, and in the basin of the N'yanza—year after year this phenomenon occurs, almost within a few hours of the same time—and to within a few inches of the same height. *Nilometer*—a graduated column standing in a kind of tank, communicating with the river—employed in measuring the rise of the Nile during its periodical floods.

Towns on the Nile.—Khartoum, Senaar, Berber, New Dongola, Derr, Thebes, Ghenneh, Cairo, Damietta, Rosetta, and Alexandria. (*Remarks to be made on these, and the position of the cataracts or rapids of the river marked on the sketch.*)

2. Describe minutely a journey by land from Teheran to Calcutta.

Starting from *Teheran*, which stands in the midst of a desert plain, we join one of the caravans by which the internal trade of Persia is carried on. Crossing the sterile region which occupies almost the entire east of the country, we enter Afghanistan, and reach *Herat*. This town is of great military and commercial importance, being the centre of a great trade between India, China, Tartary, Afghanistan, and Persia. It is regarded as the key of India on the west, and has alternately belonged to Persia and Kabul. Leaving this town and continuing our journey along a good military road, we arrive at *Kabul*. This city has an extensive trade between Russia, China, Turkestan, and India, and has been the scene of, at least, two treacherous attacks on the British in 1842 and 1879. Not far off lies the town of *Jelalabad*, which we pass on our way through the Kyber Pass to *Peshawur*, which is the frontier town of Hindustan towards Afghanistan. Since its occupation by the British its trade has greatly increased. Following the route of the proposed railway from Peshawur to *Lahur*, we pass *Attock* and *Jhelam*. From Lahur (Lahore), the capital of the Panjab, we take advantage of the railway and pass Delhi, long the metropolis of the Mohammedan Empire in India, famous for the siege in 1857; *Agra*, with the famous mausoleum of Shah Jehan; *Kanhpur* (Cawnpore), one of the most commercial cities on the Ganges, will be long memorable as the scene of Nana Sahib's brutal atrocities; *Allahabad*, at the confluence of the Ganges and Jamna, a sacred city; *Benares*, one of the most sacred of Hindu cities, a very busy place; *Patna*, with a large trade; *Chandernagore*, belonging to France; *Serampoor*, and soon after we arrive at our destination, *Calcutta*, the capital of British India.

3. Trace the course of a ship from London to Bombay by the Suez Canal.

(See same question answered under Second Year.)

SECOND PAPER.

Two hours and a half allowed.

History.

1. What lines of English sovereigns came from Wales and Scotland respectively? Distinguish between their title to the throne.

From Wales came the Tudor line. The first of the line was Henry VII., who was grandson of Owen Tudor, a Welsh gentleman, and Catherine, widow of Henry V. Henry's claim to the throne was rather shaky, and though he claimed it by inheritance and by conquest, yet he had to obtain from the Pope a bull, excommunicating all who should disturb him or his heirs. For fifteen years his seat was one of much danger, for plot after plot rose to annoy him. In 1502 a marriage was arranged between James IV. of Scotland and Margaret, Henry's eldest daughter. From this marriage resulted the union of the English and Scottish Crowns in the person of James VI., by which Scotland gave a king to England in 1603. James was the first of the Stuart line on the English throne. By the death of Elizabeth, the last of the Tudor line, without heirs, James who represented the Tudor claim, became the undisputed king of the whole island. His cousin, Arabella Stuart, was made the puppet of a few schemers, but the plot was easily snuffed out.

2. When and under what circumstances did the English begin to found colonies? Of what benefit are our colonies to the people?

The reign of James I. is noteworthy for the beginning of the great colonial empire of Great Britain. In 1607 James granted a charter to a company of traders who founded a colony in the district, now called Virginia, and named its capital James Town. In 1610 Lord Delaware proceeded to the colony of Virginia, and thus were laid the foundations of the now great Republic of the United States.

The advantages of the colonies to the people are the opportunities which industrious labourers and small capitalists have of mending their condition, by emigrating to a country where labour is wanted, and where land can be had at a very small price. They furnish a new home for thousands of poor, who find it a difficult matter to gain a livelihood in their own country.

3. What rebellions has England had to encounter in America and Asia during the present reign? By what means has she removed discontent?

During the present reign, in 1857, when a mutiny of the Sepoys broke out at Meerut, in India, and for a year a horrible war raged, in which foul massacres were perpetrated by human fiends. At the end of the war, the government of India was vested in the Crown, 1858. Hitherto the East India Company had shared in the exercise of political functions, for which it was wholly unqualified. The Government of this great dependency is now conducted by a responsible minister, with the advice of a Council of State. A just, mild, and peaceful dominion has now taken the place of gross oppression, the learning of Europe has been introduced, and natives of India, men of high talent and character have been admitted to a share of power, and sit in the Viceroy's Council side by side with the ablest soldiers and civilians. The visit of the Prince of Wales a few years ago had a very beneficial effect.

In 1837 a rebellion headed by Papineau and Mackenzie, disturbed Upper and Lower Canada. This was defeated, and in the following year, during the winter, a second rising took place, but it was soon suppressed. To strengthen the government of the Colony an Act of Parliament was passed in 1840, by which the two provinces were united, and the legislative councils of the united provinces were consolidated. A modification of the Constitution took place in 1853, giving a more democratic representation to the country, but in 1867 all previous laws on the subject were repealed, which federally united into one dominion the former separate provinces of Canada, Nova Scotia, and New Brunswick. As originally intended, the Confederation was contemplated to include the whole of the British North American possessions, and such is gradually being the case.

Riel's rebellion, in 1870, was easily suppressed by Colonel (now Sir Garnet) Wolseley.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including (if possible) No. 2.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of the one of them greater than the angle contained by the two sides equal to them of the other; the base of that which has the greater angle shall be greater than the base of the other.

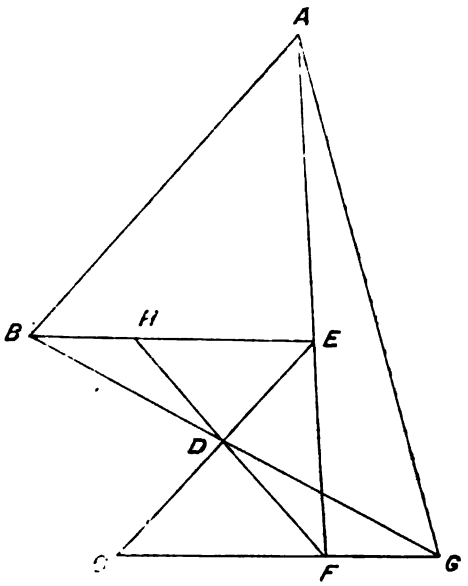
Prop. 25, Bk. I.

2. In any triangle ABC, if BE, CF be perpendiculars on any line through A, and D be the bisection of BC, show that DE = DF.

(Produce ED to meet CF in G; prove ED=DG, and then DF=ED=DG.)

I et ABC be any triangle; let AF be any line drawn through A, upon which let BE, CF be perpendiculars, join E and F with D the bisection of the base. DE shall be equal to EF.

Produce ED, CF to meet in G. Because BD=DC and the angles DBC, DCG are equal; as also BED, DGF, BE being parallel to GC, then (I. 26) the triangles BDE, DGC are equal in every respect. ∴ ED=DG.



Produce FD to meet BE in H; then since the sides ED and DG are equal, as also the angles EHD, DFG, and the angles HDE, GDF, then (I. 26) the triangles HDE, GDF are equal in every respect. ∴ HD=DF, and HE=GF.

Again, since in the two triangles HEF, GFE, HE=GF, EF is common and the angles at E and F right angles; then (I. 4) the triangles are equal in every respect, and ∴ the angle HFE = the angle GEF, and ∴ DE=DF. Q. E D.

3. Parallelograms upon the same base and between the same parallels are equal to one another.

Prop. 35, Bk. I.

Algebra.

MALES.

Answer two Questions, including (if possible) No. 2.

1. Subtract the product of $a^2+b^2+c^2$ and $a^2-b^2-c^2$ from the product of $a^2-b^2+c^2$ and $a^2+b^2+c^2$.

(1)

$$\begin{array}{r} a^2+b^2+c^2 \\ a^2-b^2-c^2 \\ \hline a^4+a^2b^2+a^2c^2 \\ -a^2b^2 \qquad -b^4-b^2c^2 \\ -a^2c^2 \qquad -b^2c^2-c^4 \\ \hline a^4 \qquad -b^4-2b^2c^2-c^4 \end{array}$$

(2)

$$\begin{array}{r} a^2-b^2+c^2 \\ a^2+b^2+c^2 \\ \hline a^4-a^2b^2+a^2c^2 \\ a^2b^2 \qquad -b^4+b^2c^2 \\ a^2c^2 \qquad -b^2c^2+c^4 \\ \hline a^4 \qquad 2a^2c^2-b^4 \qquad +c^4 \\ a^4 \qquad -b^4-2b^2c^2-c^4 \\ \hline 2a^2c^2 \qquad +2b^2c^2+2c^4= \end{array}$$

by subtracting

$2c^2(a^2+b^2+c^2)$ Ans.

2. Prove that $a^5 \times a^7 = a^{12}$.

Reduce to lowest terms $\dfrac{a^3by^2z-ab^2y^2z^2}{aby^2z^2}$.

(*a*) Since from the notation in Algebra a^5 means that a is to be multiplied by itself five times; a^7, that a is to be multiplied by itself seven times; therefore it may be given as a rule, *that the powers of a number are multiplied by adding the exponents*, for $a^5 \times a^7 = a\times a\times a\times a\times a\times a\times a\times a\times a\times a\times a\times a = a^{12} = a^{5+7}$.

(*b*) $\dfrac{a^3by^2z-ab^2y^2z^2}{aby^2z^2} = \dfrac{a^2-bz}{z}$ Ans.

The G. C. M. $= aby^2z$.

3. Solve the equations:—

(1) $\dfrac{2x-10}{3}-15=\dfrac{3x-40}{11}-\dfrac{57-x}{5}$

(2) $\dfrac{4x+3}{2x+1}-\dfrac{3}{3x+2}=\dfrac{4x-9}{2x+1}$

(1) $\dfrac{2x-10}{3}-15=\dfrac{3x-40}{11}-\dfrac{57-x}{5}$

clearing of fractions $110x-550-2475=45x-600-1881+33x$

$110x-45x-33x=550+2475-600-1881$

$32x=544$

$x=17$ Ans

(*b*) by transposing $\dfrac{4x+3}{2x+1}-\dfrac{4x-9}{2x+1}=\dfrac{3}{3x+2}$

$\dfrac{12}{2x+1}=\dfrac{3}{3x+2}$

clearing of fractions $36x+24=6x+3$

$30x=-21$

$x=-7$ Ans.

Needlework.

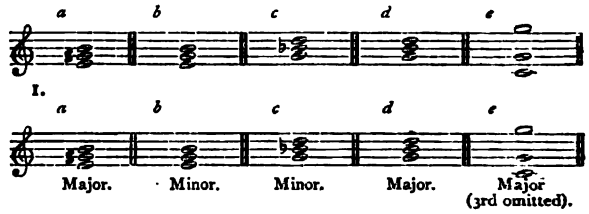
FEMALES.

One hour allowed for this Exercise.

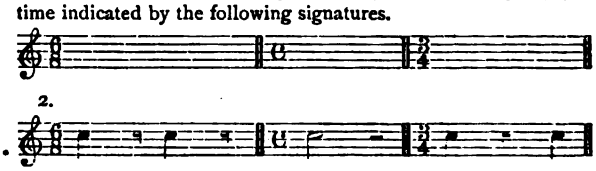
Music.

A quarter of an hour allowed for this Paper.

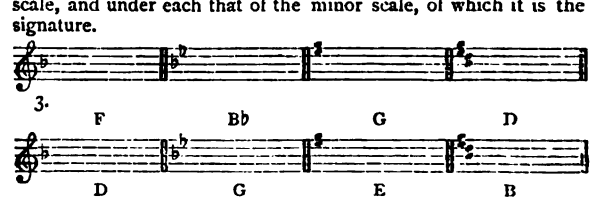
1. Which of the following chords are major and which minor?



2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. If 15 cwt. 1 qr. 2 lbs. of sugar be bought for £52 0s. 3d., at what price per pound should it be sold to gain 15 per cent.?

$$\frac{115}{100} \text{ of } \frac{£52 \text{ 0s. } 3\text{d.}}{15 \text{ cwts. } 1 \text{ qr. } 2 \text{ lbs.}} = \frac{23}{20} \text{ of } \frac{1248003}{1710}\text{d.}$$

$$= \frac{23 \times 73}{200}$$

$$= \frac{1679}{200} = 8\frac{79}{200}\text{d.} \quad \text{Ans.}$$

2. If a farthing be the interest on a shilling for a calendar month, what is the rate per cent. per annum?

¼d. per shilling for 12 months = 3d. per shilling per annum.
∴ 3d. = ¼ of principal, *i.e.*, $\frac{12}{4}$ or 25 p. c.

3. Distinguish between interest and discount. Show that the interest on £450 for 7 months at 4 per cent. per annum is equal to the discount on £460 10s. for the same time at the same rate per cent.; and explain why these two sums are equal.

Interest is the name given to any sum of money paid in return for a loan of money.

If a sum of money be due at a future time, and it is desired to discharge the debt now, a smaller sum is usually taken in payment. This smaller sum is called the present worth, or present value of the sum due at the future date, and the difference between the two sums is known as *discount*, which is simply an allowance or abatement granted in consideration of the payment of a sum of money before it becomes due.

(*a*) Interest on £450 for 7 mos. at 4 p.c. $= £450 \times \frac{7}{12} \times \frac{4}{100}$

$$= \frac{£450 \times 7 \times 4}{12 \times 100}$$

$$= £\frac{126}{10} = £10 \text{ 10s.} \quad \text{Ans.}$$

(*b*) Interest on £100 for 7 mos. at 4 p.c. $= £\frac{28}{12} = 2\frac{1}{3}$
Amt. of " " " $= £102\frac{1}{3}$.
∴ £102⅓ : £2⅓ :: £460 10s. : discount.

$$\frac{£460\frac{1}{2} \times 2\frac{1}{3}}{102\frac{1}{3}} = \frac{£921 \times 7}{2 \times 307}$$

$$= £\frac{21}{2} = £10 \text{ 10s.} \quad \text{Ans.}$$

The sums are identical, because the true discount is the interest on the present value; and the present value of £460 10s. after the abatement is made, is £450.

4. What is the cost of the flooring of a room consisting of 36 planks each 10½ feet long, 8 inches wide, and 3 inches thick, if a cubic foot of the timber is worth 1s. 7½d.?

(*a*) (126 in. × 8 in. × 3 in.) × 36 $= \frac{126 \times 8 \times 3 \times 36}{1728}$ c. ft. = 63 c. ft.

(*b*) 63 ft. at 1s. 7½d. = £5 2s. 4½d. Ans.

5. If I invest £5,000 thus: three-fourths of it in 3½ per cent. stock at 92⅛, one-tenth of it in the 3 per cents at 89¼, and the rest in India 4 per cent. stock at 98¾, what annual income shall I derive from the whole investment?

Income from—

£3750 × $\frac{3\frac{1}{2}}{92\frac{1}{8}} = \frac{3750 \times 26}{739}$ = £131$\frac{481}{739}$ = £131 $\frac{4}{5}\frac{8}{9}\frac{8}{1}\frac{1}{3}\frac{1}{9}$

" £500 × $\frac{3}{89\frac{1}{4}} = \frac{500 \times 12}{357}$ = £16$\frac{68}{119}$ = £16 $\frac{8}{10}\frac{8}{14}\frac{0}{17}\frac{4}{8}\frac{8}{5}$

" £750 × $\frac{4}{98\frac{3}{4}} = \frac{750 \times 16}{395}$ = £30$\frac{48}{79}$ = £30 $\frac{3}{6}\frac{8}{2}\frac{8}{4}\frac{1}{7}\frac{3}{9}\frac{3}{5}\frac{0}{0}$

Total income £179 $\frac{1}{6}\frac{4}{0}\frac{4}{0}\frac{2}{4}\frac{1}{7}\frac{0}{3}\frac{0}{5}$

∴ Total income £179 2s. $5\frac{1}{2}\frac{3}{8}\frac{0}{2}\frac{7}{4}\frac{2}{7}\frac{3}{3}\frac{0}{5}$d. Ans.

FEMALES.

1. If the carriage of 37 stone 6 lbs. for 7 miles cost £2 5s., what weight should be carried 12 miles for £3 10s.?

45s. : 70s.
12 mls. : 7 mls. } :: 37 st. 6 lbs. : weight.

$$\frac{520 \text{ lbs.} \times 70 \times 7}{45 \times 12} = \frac{12838}{27} \text{ lbs.} = \underline{33 \text{ st. } 13\frac{13}{27} \text{ lbs.}} \quad \text{Ans.}$$

2. In what time will £225 amount to £256 10s. at 3½ per cent.?

Interest for the time = (£256 10s. − £225) = £31 10s.

£225 : £100
3½ : 31½ } :: 1 year : time.

$$\frac{1 \text{ yr.} \times 100 \times 63}{225 \times 7} = \underline{4 \text{ yr.}} \quad \text{Ans.}$$

3. A person buys shares in a railway when they are at £19½, £15 having been paid, and sells them at £32 9s. when £25 has been paid; how much per cent. does he gain?

Prime cost of a share = £19½, and as £10 is paid on every share ∴ by selling at £32 9s. he gains (£32 9s. − £29 10s.) = £2 19s.

∴ £29½ : £100 :: £2$\frac{19}{20}$: gain p. c.

$$£\frac{59 \times 200}{20 \times 59} = \underline{£10 \text{ p. c.}} \quad \text{Ans.}$$

4. A and B enter into partnership; A contributes £3000 for nine months, and B £2400 for six months; they gain £1150; find each man's share of the gain?

3000 × ¾ = 2250 for 1 yr.
2400 × ½ = 1200 "
3450

3450 : 2250 :: £1150 : £750 = A's share. Ans.

3450 : 1200 :: £1150 : £400 = B's " Ans.

Grammar.

1. 'You will remember, no doubt, how *Wamba, the Saxon jester* in Ivanhoe, plays the *philologer, having noted that* the names of almost all animals, *so long as* they are *alive*, are Saxon, but when *dressed* and prepared for food *become* Norman."—TRENCH.

(*a*) Point out and analyse the noun sentences in the above, and give other examples of such sentences.
(*b*) Parse the words in italics.
(*c*) What is meant by the words *Saxon* and *Norman* in the above, and which of these has the largest share in the English language?
(*d*) Illustrate the fact noticed respecting the names of animals by examples, and if you are able to give a reason for it, do so.

(*a*) 1st noun sentence.—'How Wamba, the Saxon jester in Ivanhoe, plays the philologer, having noted' (object of 'will remember').
2nd noun sentence.—'That names of almost all animals are Saxon' (object of 'having noted').
3rd noun sentence.—'That (the names of all animals) become Norman.'

Noun Sentences.	Subject.	Enlargement of Subject.	Predicate.	Completion.
1st. How Wamba, the Saxon jester in Ivanhoe, plays the philologer, having noted . . .	(how) Wamba	the Saxon jester in Ivanhoe	plays	the philologer
2nd. that the names of almost all animals are Saxon	(that) the names	of almost all animals	are (*incomplete*)	Saxon
3rd. (*that the names of all animals*) become Norman	do.	do.	become (*incomplete*)	Norman

Other examples:—'*I heard that the Duke of Connaught had landed.*' '*We knew that such was the case.*'

(*b*) *Wamba*—noun, masc. sing. nom. to '*plays.*'
the—def. art. or dist. adj., limiting '*jester.*'
Saxon—dist. adj., limiting '*jester.*'

jester—com. noun, masc. sing. nom., in apposition with '*Wamba.*'
philologer—com. noun, mas. sing. nom. after '*plays.*'
having noted—reg. trans. verb, perfect part. active, attributive to '*jester.*'
that—conj., introducing a noun sentence.
so—adv. degree, mod. '*long.*'
long—adv. time, mod. '*are Saxon.*'
as—subord. adv. conj., introd. adverbial sentence.
alive—predicative adj., qual. '*they.*'
dressed—part. adj., qual. '*they.*'
become—irreg. intrans. verb, *become, became, become*, indic. pres. indef., 3rd pers. plur., agr. with ('*they*').

(*c*) By 'Saxon' and 'Norman' is meant that one class of words is of Saxon origin and another of Norman. Saxon was the language of the conquered race, and Norman-French that of their conquerors. The Saxon has by far the largest share in the English language.

(*d*) Saxon *sheep*, when cooked, became the French (mouton) *mutton.*
Saxon *cow, ox, bull*, when cooked, became the French (bœuf) *beef.*
Saxon *calf*, when cooked, became the French (veau) *veal.*
Saxon *deer*, when cooked, became the French (venaison) *venison.*
Saxon *swine*, when cooked, became the French (porc) *pork.*

The change of these words shows that the Saxons attended to the keeping of the animals, and to the cooking of the flesh for their Norman masters, who retained the French names.

Geography.

1. Draw a full map of South America, inserting the lines of latitude and longitude.

2. Three travellers are leaving Melbourne for England. One means to go by San Francisco, one by Suez, one round Cape Horn. Describe their routes.

The first traveller, leaving Liverpool, would sail by Queenstown across the Atlantic to New York, and, taking the cars, proceed to Chicago by the Pacific Railway, thence past Council Bluffs, Omaha, Cheyenne, Great Salt Lake City, Sacramento, to San Francisco. Thence he proceeds by steamer across the Pacific Ocean, *viâ* Honolulu, to Melbourne.

The second proceeds from Southampton down the English Channel, the Bay of Biscay, along the coast of Portugal, through the Straits of Gibraltar, nearly the whole length of the Mediterranean, to Port Said, down the Suez Canal to Suez, across the Arabian Sea to Point de Galle in Ceylon, S.E. through the Indian Ocean to the S.W. corner of Australia, and along the South Coast to Melbourne.

Note.—The above journey might have been shortened by going through France and Italy to Brindisi, then proceeding by steamer to Suez Canal.

The third, leaving Southampton, proceeds southwards to the coast of Brazil, down the South Atlantic, in a south-westerly direction to the Falkland Islands, thence round Cape Horn, and across the South Pacific to Australia.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What English sovereigns have lost the throne through violence? Describe the end of one of those whom you name.

	A.D.	A.D.
Harold II.	1066	
William II., Rufus	1087 to	1100
Edward II.	1307 ,,	1327
Richard II.	1377 ,,	1399
Henry VI.	1422 ,,	1461
Edward V.	1483	
Richard III.	1483 ,,	1485
Charles I.	1625 ,,	1649

The last English king who died a violent death was Charles I., who was executed 30th January, 1649. He was conducted to Whitehall by Major Harrison. Next day the Court of Justice met in Westminster Hall, and on the 27th January passed sentence of death on Charles. Two days intervened between the sentence and the execution. These were spent by Charles in devotion and in parting with his children. Bishop Juxon, who accompanied him to the scaffold, said to him, 'There is, Sir, but one stage more, which, though turbulent and troublesome, is yet a very short one. It will carry you to heaven, and there you shall find a crown of glory.' 'I go,' said Charles, 'from a corruptible to an incorruptible crown, where no disturbance can have place.' At one blow his head was severed from his body. The executioner held up the head and said, 'This is the head of a traitor.'

2. Sketch the character of George III., and explain his failure as a constitutional king.

George III. was a pious man, with the best intentions for his country's welfare, and was devoted to what he thought to be his duty. His simple, homely way of life, his plain, kindly manners, his unaffected goodness, won for him and kept for him, in spite of his grievous errors of judgment, the affection of a people knowing how to value honesty of purpose and true religion in lofty stations of life. His narrow views of things arose from the seclusion of his early life, and from an imperfect education. He had been brought up by his mother, the Dowager Princess of Wales, and by her favourite adviser, the Earl of Bute, in high notions of the royal power and prerogative. This training led him into arbitrary conduct, which he persisted in most obstinately, and which eventually brought disaster to the country.

3. What advantages is it likely that a people will derive from facilities of intercourse with foreign nations?

This is well answered by Mr. Mackenzie in 'The Nineteenth Century,' as follows:—'During the early part of the century men had scarcely the means to go from home beyond such trivial distance as they were able to accomplish on foot. Human society was composed of a multitude of little communities, dwelling apart, mutually ignorant, and therefore cherishing mutual antipathies. At once the causes of separation were withdrawn. Men of different towns, of different countries, were permitted freely to meet; to learn how little there was on either side to hate, how much to love; to establish ties of commercial relationship; to correct errors of opinion by friendly conflict of mind . . . Ancient prejudice melts away under the fuller knowledge gained by this extended acquaintance.'

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Inexhaustible.*

Write, in small hand, as a specimen of copy-setting, *One gladdening beam of cheerful light.*

Composition.

Write an essay on *Bees.*

There are two principal kinds of bees—the wild and the hive, or honey bee. The latter are divided into the *working* bees, the *drones*, and the *queen* bee. The working bees are females, and collect the honey and wax; the drones are males, and do no work; while the queen lays all the eggs, and is the mother of the hive. The bee is half an inch long, black and brown in colour, and is covered with hairs. It has a proboscis for sucking up the nectar, which she collects in her honey-bag. There are three pair of legs, the hind ones having a bag to hold the yellow dust for making wax. The lungs of the insect are under the wings; they are, in fact, open air-cells through which the bee breathes. She is also provided with a sting, which is a double dart in a sheath, having a venom-bag at its root, the poison flowing along a groove when the weapon enters the object of enmity. There are five eyes, two in front and three on the top of the head. She has also two feelers, with which it builds its cells, feeds its young, stores the hive, and caresses its friends.

The cells of the bee are arranged in the hive with great regularity; being hexagonal, they pack together better than if they had been shaped otherwise. The cells are used as storerooms for honey, and as nurseries for the young. The royal cells are situated in the centre of the hive. The young are fed by nurse

bees, on honey, pollen, and water, but the royal offspring are fed on rich jelly. Only one queen exists in a hive at one time; if two happen to meet in the same hive, they either fight till one is slain, or one leaves with a swarm for a fresh hive.

In America and other countries bees form an important branch of industry, and in our country cottagers often augment their incomes by bee-keeping. The bee has been held up to boys as an example of industry in those memorable lines of Isaac Watts—

'How doth the little busy bee,' etc.

Euclid.

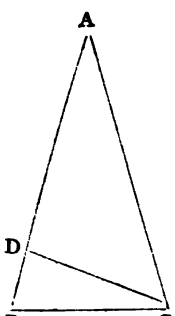
MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two questions, including No. 2, if possible.

1. If the square described upon one of the sides of a triangle be equal to the squares described upon the other two sides of it, the angle contained by these two sides is a right angle. Prop. 48, Bk. I.

2. From one of the equal angles of an isosceles triangle a perpendicular is drawn to the opposite side; show that the square on the base is equal to twice the rectangle contained by that side and the part of it between the perpendicular and the base. (Apply I., 47, then II., 4, and II., 3.)



The sq. on AC = sqs. on AD and DC, but AC = AB, ∴ the sq. on AB = sqs. on AD and DC; but sq. on AB = the sqs. on AD and DB and twice the rect. AD·DB, ∴ sqs. on AD and DB + twice rect. AD·DB = sqs. on AD and DC; take away the common sq. on AD, and the sq. on DB + twice the rect. AD·DB = sq. on DC; to each of these equals add the sq. on DB, and twice the sq. on DB + twice rect. AD.DB = sqs. on DB and DC, but (by II. 3) the rect. AB·BD = sq. on DB and rect AD·DB, ∴ twice the rect. AB·BD = sqs. on DB and DC, *i.e.* twice the rect. AB·BD = BC². Q. E. D.

3. If a straight line be bisected, and produced to any point, the rectangle contained by the whole line thus produced, and the part of it produced, together with the square on half the line bisected, is equal to the square on the straight line which is made up of the half and the part produced. Prop. 6, Bk. II.

Algebra.

MALES.

Answer two questions, including No. 2, if possible.

1. Find the time in which A, B, and C can together do a piece of work which A can do in a days, B in b days, and C in $\frac{1}{2}(a+b)$ days.

A does $\frac{1}{a}$ in one day; or, $\frac{ab+b^2}{a^2b+ab^2}$

B " $\frac{1}{b}$ " " " $\frac{a^2+ab}{a^2b+ab^2}$

C " $\frac{2}{a+b}$ " " " $\frac{2ab}{a^2b+ab^2}$

∴ A, B, and C do in one day $\frac{a^2+4ab+b^2}{a^2b+ab^2}$;

they will do the whole in $\frac{a^2b+ab^2}{a^2+4ab+b^2}$ days $= \frac{ab(a+b)}{2ab+(a+b)^2}$ Ans.

2. Prove the rule for dividing one algebraical fraction by another, the letters standing for any numbers.

Divide $\frac{a^2+b^2}{2a^2}-\frac{2b^2}{a^2+b^2}$ by $\frac{a^2+b^2}{2b^2}-\frac{2a^2}{a^2+b^2}$

(*a*) Rule. 'Invert the divisor and proceed as in Multiplication (that is, invert the divisor, and multiply the numerators together for a new numerator, and the denominators together for a new denominator).'

For if $\frac{a}{b}$ and $\frac{c}{d}$ be the proposed fractions, and we suppose $\frac{a}{b} = x$ and $\frac{c}{d} = y$, then $a = bx$, and $c = dy$

$\therefore ad = bdx$, and $bc = bdy$;

therefore $\frac{ad}{bc} = \frac{bdx}{bdy} = \frac{x}{y}$; but $\frac{x}{y} = x \div y = \frac{a}{b} \div \frac{c}{d}$,

therefore $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc} = \frac{a}{b} \times \frac{d}{c}$.

(*b*) (1) $\frac{a^2+b^2}{2a^2}-\frac{2b^2}{a^2+b^2}=\frac{a^4+2a^2b^2+b^4-4a^2b^2}{2a^4+2a^2b^2}$

(2) $\frac{a^2+b^2}{2b^2}-\frac{2a^2}{a^2+b^2}=\frac{a^4+2a^2b^2+b^4-4a^2b^2}{2b^4+2a^2b^2}$

Dividing (1) by (2) we have

$$\frac{(a^4+2a^2b^2+b^4-4a^2b^2)(2b^4+2a^2b^2)}{(2a^4+2a^2b^2)(a^4+2a^2b^2+b^4-4a^2b^2)}=\frac{2b^2(b^2+a^2)}{2a^2(b^2+a^2)}=\frac{b^2}{a^2}$$

3. Solve the equations :—

(1) $x+y=a$
$ax+by=b^2$

(2) $x^2+(x-7)^2-2x+7=32282$.

Show that the latter is the algebraical expression of the question :—'Find two numbers differing by 7 which are altogether less than the sum of their squares by 32282.

(1) $x+y=a$ or $ax+ay=a^2$
and $ax+by=b^2$
(subtracting) $(a-b)y=a^2-b^2$
$y=a+b$ Ans.
Hence $x=-b$ Ans.

(2) $x^2+(x-7)^2-2x+7=32282$
$x^2+x^2+49-14x-2x+7=32282$
$2x^2-16x=32226$
$x^2-8x=16113$
$x^2-8x+16=16129$
$x-4=\pm 127$
$x=4\pm 127=131$ or -123 Ans.

If x = the greater number, then $x-7$ = the less.
∴ their sum $= (2x-7)$ and the sum of their squares is $x^2+(x-7)^2$.

Now if we subtract their sum from the sum of their squares, the expression is $x^2+(x-7)^2-(2x-7)$, which equals 32282, that is $x^2+(x-7)^2-2x+7=32282$. Q. E. D.

Mensuration.

MALES.

Answer one Question.

1. Find the cost of papering a room 21 feet long, 15 wide, and 12 high, with paper $2\frac{1}{2}$ feet wide, at 9d. a yard, allowing for a door 7 feet high and 3 wide, two windows, each 5 feet high and 3 wide, and a panelling 2 feet high round the floor.

sq. ft.
(21 ft. × 12)2 = 504 = area of two side walls.
(15 ft. × 12)2 = 360 = " " end "
864

sq. ft.
7 ft. × 3 = 21 area of door
(5 ft. × 3)2 = 30 " windows
(42+30)2 = 144 " panelling
} total to be deducted 195 sq. ft.

864 sq. ft. − 195 sq. ft. = 669 sq. ft. to be papered.

$\frac{669}{2\frac{1}{2}} = \frac{1338}{5} = 267\frac{3}{5}$ ft. at 3d. a foot =

$66\frac{9}{10}$s. = £3 6s. $10\frac{1}{2}$d.

2. Find the side of an equilateral triangle, supposing it cost as much to pave the area at 9d. per square foot as to fence the three sides at five shillings per foot.

Let x ft. = the side of the equilateral triangle
then $3x$ = the perimeter in lineal ft.
and $\cdot 433x^2$ = the area in sq. ft.
9d. × $\cdot 433x^2$ = 60d. × $3x$
$3\cdot 897x = 180$
$x = \frac{180}{3\cdot 897} = 46\cdot 188$ ft.

Needlework.

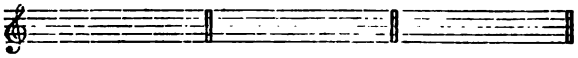
FEMALES.

One hour allowed for this exercise.

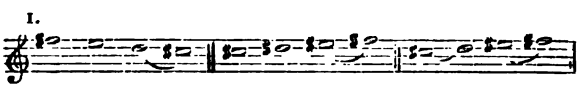
Music.

A quarter of an hour allowed for this paper.

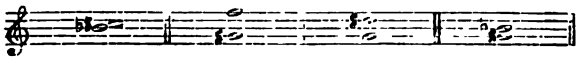
1. Write the upper tetrachord of F♯ (*Fe*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



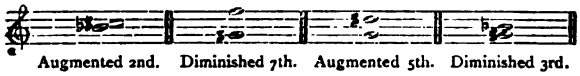
1.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.

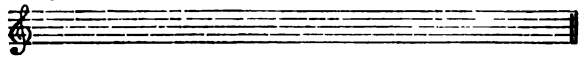


2.

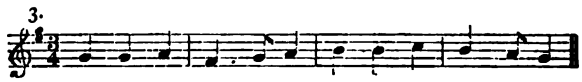


Augmented 2nd. Diminished 7th. Augmented 5th. Diminished 3rd.

3. Write, from memory, the first four or more measures of any tune you can remember.



3.



Publications Received.

Arithmetic—
(1) Comprehensive Arithmetic. Blackie and Co.

Education—
(1) The New Code. Grant and Co.
(2) Millard's Grammar of Elocution. Longmans, Green, and Co.

Geography—
(1) Map of Ireland. W. and A. K. Johnston.
(2) Elementary Atlas. Philip and Son.

Grammar—
(1) Daziel's English Grammar. Menzies and Co.

Greek—
(1) Paley's Greek Particles. G. Bell and Sons.

History—
(1) Marshall's English History Readers. Marshall and Sons.
(2) Keep's Summary of English History. Longmans, Green, and Co.
(3) Powell's Old Stories from English History. Longmans, Green, and Co.

Miscellaneous—
(1) Prendergast's Handbook to Mastery Series. Longmans, Green, and Co.

Periodical Literature—
(1) Universal Instructor, Part XXII. Ward and Lock.
(2) Sports and Pastimes, Part V. Cassell, Petter, and Galpin.
(3) The Competitor, Part I. T. Fisher Unwin.
(4) Our Little Ones, No. 10. Griffith and Farran.

Science—
(1) Dunman's 'Talks about Science.' Griffith and Farran.
(2) Larden's School Course on Heat. Sampson Low and Co.

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the question has been set.*]

Arithmetic.

STANDARD I.

97		7	
6		680	5×8
890		95	3×7
1000	990	1000	4×9
907	99	709	6×7
Ans. 2900	Ans. 891	Ans. 2491	

Quite, Master, Cage, Harvest, Work, Chickens.

STANDARD II.

25050
9066
Ans. 15,984

98006×705. Ans. 69,094,230
61565÷ 9. Ans. 6840,—5

6
907
26037
5036
7080
98
Ans. 39,164

STARDARD III.

(1) From £2,000,000 take £68 19s. 11¼d.
Ans. £1,999,931 0s. 0¾d.

(2) Divide six hundred thousand by sixty-seven.
Ans. 8955—15.

(3) A boy went to the Post Office with 10s. in his pocket. He bought a sevenpenny packet of cards, 2 doz. halfpenny stamps, 4 penny receipt stamps, and 3 other penny postage stamps. What change had he?
Ans. 7s. 10d.

STANDARD IV.

(1) Multiply £5017 13s. 6¾d. by 68.
Ans. £341,202 2s. 3d.

(2) Find the 7th part of £1,891,061 12s. 7¼d.
Ans. £270,151 13s. 2¾d.

(3) I want to distribute 6 lbs. 15 ozs. of sweets among 37 boys and 37 girls, giving the girls double what the boys get; what did each receive?
Ans. Boy 1 oz., girl 2 ozs.

(4) Divide £78,019 9s. 0¾d. by 819.
Ans. £95 5s. 2¾d.—306.

(5) Write out avoirdupois weight.

STANDARD V.

(1) 13068 at £1 7s. 5¾d. Ans. £17,954 17s. 9d.

(2) Bill—

	£	s.	d.
3 gross at 4½d. per doz. ...	0	13	6
1 pt. Ink at 7s. per gallon ...	0	0	10½
1 gross at 6 for 5d.	0	10	0
3 reams at 6d. per quire ...	1	10	0
2000 envelopes at 9d. per 100	0	15	0
Ans.	£3	9	4½

(3) 7 cwt. 3 qrs. 19 lbs. 11 ozs. at £37 12s. 6d. per ton. Ans. £14 18s. $2\frac{2}{5}\frac{1}{6}$d.

(4) If a bankrupt owes £4726 10s., and his effects are worth £1181 12s. 6d., how much will he pay in the £? Ans. 5s.

STANDARD VI.

(1) 4 qts 3 pts. to the decimal of 1 barrel.
Ans. ·038194.

(2) If a watch gains 20 mins. 4 secs. in 12 days 4 hrs. 23 mins., what would a similar watch gain in 12 yrs. 3 mths. 4 wks. 20 mins., at the same rate?

This question is puzzlingly indefinite in the last term, so that out of any number working it, scarcely two could be expected to get the same result. *We* have reckoned the years as 365 days each + 3 days for leap years, and the 3 months as $\frac{1}{4}$ of 365 days; giving a total of 4502d. 6h. 20m. = 6,483,260m. And 12d. 4h. 23m. = 17,543.

Then $\frac{6}{17}\frac{18}{54}\frac{3}{3}\frac{0}{0}\frac{6}{0}$ of 1204 scs. = $444954\frac{17}{17}\frac{0}{54}\frac{18}{33}$ scs. =
Ans. 5 d. 3 h. 35 m. $54\frac{17}{17}\frac{0}{54}\frac{18}{33}$ sec.

(3) Divide ($\frac{8}{7}$ of 4) by ($\frac{5}{9}+\frac{2}{3}$). Ans. $2\frac{6}{11}$.

(4) If a lady spent $\frac{1}{6}$ of her money in one shop, $\frac{1}{5}$ in another, and had £5 1s. 4d. left, how much did she start with? Ans. £8.

(5) What would be the weight of 9 crowns, 10 half-crowns, 12 sixpenny bits, and 13 fourpenny bits, if 66 shillings were coined to a lb. (Troy)?
Ans. 1 lb. 2 oz. 12 dwts. $2\frac{10}{11}$ gr.

Algebra.

(1) Find the value of $2\{3x-4y-3(5x-y)\}$
When $x=3$ cwt. 3 qrs. 18 lbs.
$y=$ 1 ,, 13 ,,
Ans. − 4 tons 14 cwts. 2 qrs. 10 lbs.

(2) Find the value of $\frac{1}{3}(7x-5y)-\frac{1}{5}(6y-2z)$.
When $x=$ £1 1 0
$y=$ 0 6 8
$z=$ 0 3 4
Ans. £1 11s. $2\frac{2}{3}$d.

(3) Express algebraically x mins. past 10, and y mins. to 11 o'clock, and find the difference between these two times. Prove your answer by putting $x=20'$ and $y=15'$.

Ans. $-10+\frac{x}{60}$; $11-\frac{y}{60}$; $1-\frac{x}{60}-\frac{y}{60}$; 25 mins.

(4) If a man buys $x+y$ articles at 5s. per piece, and sells x of them at 4s., and the rest at 6s., how much does he gain? What does the answer become when $x=12$ and $y=8$? Explain your answer.
Ans. $y-x$; 4s. loss.

(5) $a=0$ $b=5$ $c=3$ $d=10$.
Find value of $\frac{ab+2bc-3cd}{2a+3b}$ and $\frac{a^2-b^2+c^2}{3bc}$.
Ans. -4; $-\frac{16}{45}$

(6) How would you express, algebraically, that a thermometer is 5° below zero? What would the temperature become if − 3° were subtracted from it?
Ans. − 5°; − 2°.

Euclid.

(1) Bisect the angle PQR. Ans. Euclid I. 9.

(2) From the point D, not in the line FG, draw a perpendicular to FG. Ans. Euclid I. 12.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

EXERCISE X.

(1) $a^3+a^2b+ab^2+b^3$. (2) $a^3+a^2b+ab^2+ac^2+b^3+bc^2$. (3) $6x^2+13xy+6y^2$. (4) x^3-5x^2+9x-9. (5) $a^2+3ac-4b^2-6bc$. (6) $x^3-ax^2-a^2x+a^3$. (7) $x^4-2a^2x^2+a^4$. (8) $8a^2b^2-4ab^3-12b^4$. (9) $a^2+2ab+b^2$. (10) $4a^2+4b^2+4c^2+8ab+8ac+8bc$. (11) $x^2+y^2+z^2+2xy+2xz+2yz$. (12) $a^2+3a^2b+3ab^2+b^3$. (13) $a^2-b^2+2bc-c^2$. (14) $36a^2-30ab-36b^2$. (15) $-6a^5b^2-12a^4b^2c^2+a^3b^3+2a^2b^3c^2$. (16) $10x^3y^3-8x^2y^2z$.

EXERCISE XI.

(1) $a^2-2ab+b^2$. (2) m^2+mn+n^2. (3) $y^2-2yz+z^2$. (4) m^2-n^2. (5) a^2+4a+4. (6) $9a^2+12ab+4b^2$. (7) a^2-b^2. (8) x^2-1.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

STANDARD III.

A. 1. 3,717,398—7.
2 442,436—8.
3. 2170—330.
B. 1. 6942—76.
2. 83,008—929.
3. £3317 5s. 6½d.
C. 1. £84,379 5s. 4d.
2. 6558—28,850.
3. £499 2s. 1½d.
D. 1. 223—37,659.
2. £29 3s. 9d.
3. £136 16s.
E. 1. 7.204,134.
2. £14 11s. 1d.
3. £1854 18s. 4d.
F. 1. 136 rem.
2. £542 5s. 5¾d.
3. 1304—65,586.

ADVANCED EXAMINATION.
1. £33 6s. 8d.
2. £3 19s. 1½d. saddle; £1 6s. 4½d. bridle.
3. £1 6s. 1½d.

STANDARD IV.

A. 1. £34,082 9s. 0¾d.
2. £75,825 2s.
3. £452 6s. 10¾d.—15.
B. 1. £12,894 17s. 9d.
2. £83 17s. 9¾d.—202.
3. 13 408,500 sec.
C. 1. £84 11s. 7¾d.—8971.
2. 29,395,275 farth.
3. 223 tons, 10 cwt., 3 qrs., 27 lbs., 1 oz.
D. 1. 245,025 sq. ft.
2. 15s. 5¾d.—42,257.
3. 617,760 inches.
E. 1. £3457 19s. 9d.
2. 200,375 grains.
3. 216 tons 8 cwt. 2 qrs. 15 lbs.
F. 1. 429,906,432 dr.
2. 2212 books.
3. 4014,489,600 inches.

ADVANCED EXAMINATION.
1. £25 0s. 6d. gain.
2. 7½d an hour.
3. Sept. 23rd, at 1.14 a.m.

STANDARD V.

A. 1. £580 8s. 10½d.
2. £668 11s. 5½d.
3. £3294 12s. 2¼d.
B. 1. £689 15s. 3¾d.
2. £2058 9s. 11¼d.
3. £7825 17s. 2¾d.
C. 1. £2751 10s. 6¼d.
2. £5643 18s. 6¾d.
3. £113,763 8s. $10\frac{1}{4}$d.
D. 1. £4 13s. 2¾d.
2. £4805 13s. $10\frac{3}{10}$d.
3. £11 3s. 9½d.
E. 1. £927 16s. 6¼d.
2. £20 0s. 8d.
3. 143½ lbs.
F. 1. £36 1s. 5¾d.
2. £261 14s. 4½d.
3. £564 15s. 8¾d.

ADVANCED EXAMINATION.
1. 7s. 6d. each girl.
2. £30 12s. 9d.
3. 20 days.

STANDARD VI.

A. 1. $3\frac{8}{13}\frac{3}{0}$.
2. $\frac{3}{4}$.
3. $9\frac{1}{16}$.
B. 1. 2·3705.
2. 22·455.
3. 3s. $10\frac{1}{20}$d.
C. 1. $105\frac{1}{12}$ shirts.
2. $\frac{2}{3}$.
3. 2s. $7\frac{1}{20}$d.
D. 1. $6\frac{9}{13}$ days.
2. $\frac{3}{8}\frac{0}{7}\frac{0}{2}\frac{8}{5}\frac{8}{6}$.
3. 3914·45625.
E. 1. £28 11 $6\frac{3}{10}\frac{3}{7}\frac{4}{5}$d.
2. 19s. $1\frac{1}{2}\frac{2}{7}\frac{7}{0}$d.
3. £9 14s. $0\frac{1}{4}^{-1}$.
F. 1. $\frac{1}{4}\frac{1}{5}$.
2. £9 13s. $11\frac{7}{11}$d.
3. £59 5s. 2¾d.

ADVANCED EXAMINATION.
1. $11\frac{1}{8}$ days.
2. £175.
3. $1\frac{4}{8}\frac{0}{1}\frac{1}{3}$ cwt.

STANDARD VII.

A. 1. £118 2s. 10½d.
2. 5⅛ per cent.
3. 3s. 9d. in the £.
B. 1. £575 5s.
2. 6$\frac{3}{17}$ per cent.
3. £60 19s. 0½d.
C. 1. £215.
2. 8s. 0$\frac{1}{13}$d.
3. 4$\frac{8}{15}$ per cent. average.
D. 1. £3133 6s. 8d.
2. £90 10s. 6·336d.
3. 3·38 per cent.

E. 1. £1 1s. 11$\frac{1}{11}$d.
2. £5025.
3. 3s. 10½d. each hat.
F. 1. £787 10s.
2. £25 18s. 6⅔d.
3. 5$\frac{70}{131}$ years.

ADVANCED EXAMINATION.

1. £4 14s. 10$\frac{8}{11}$d.
2. £1583 13s. 0$\frac{1}{11}$d.
2. £30 11s. 9$\frac{3}{17}$d.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1882.

STANDARD III.

1. 60,000 = 3000 score, which at 9d. = 27,000d.
60,000 = 5000 dozen, ,, 7d. = 35,000d.
35,000d. − 27,000d. = 8000d. = £33 6s. 8d. Ans.

2. £50 − (42g. + 12s. 6d.) = £5 5s. 6d. cost of S. and B. As the saddle costs 3 times as much as the bridle, the two cost *four* times as much as the bridle, hence £5 5s. 6d. ÷ 4 = £1 6s. 4½d. bridle, and £1 6s. 4½ × 3 = £3 19s. 1½d. saddle. Ans.

3. 4s. 9d. × 4½ = £1 1s. 4½d. father's earnings.
£1 1s. 4½d. + 4s. 9d. = £1 6s. 1½d. Ans.

STANDARD IV.

	s.	d.		£	s.			
1.	4	6 × 300	=	67	10	received for	300	yds.
	3	9 × 140	=	26	5	,,	140	,,
	2	9 × 36	=	4	19	,,	36	,,
	2	3 × 124 (rem.)	=	13	19	,,	124	,,
				£112	13	,,	600	,,

Hence £112 13s. − £87 12s. 6d. = £25 0s. 6d. Ans.

2. 7s. 6d. × 20 = £7 10s. amount received for the work.
6 × 5 × 8 = 240 number of hours' work done.
£7 10s. ÷ 240 = 7½d. Ans.

3. 71,609 min. = 49 d. 17 hrs. 29 m.
The remainder of August is 27 d. 16 hrs. 15 m.
The extension into September is 22 d. 1 hr. 14 m.
This gives the date September 23rd at 1-14 a.m. Ans.

STANDARD V.

1. Bringing the men and the girls to their equivalents in boys we have 18 men = 108 boys, and 60 girls = 90 boys; then 108 + 0 + 12 = 210 boys. £52 10s. ÷ 210 = 5s. a *boy's* share, and 5s. × 1½ = 7s. 6. Ans.

2.

		s.	d.	£	s.	d.
18¼	at	6	9	= 6	3	2¼
163½	at	1	4½	= 11	4	9¾
8¼	at	11	9	= 4	16	11¼
3¾	at	16	3	= 3	0	11¼
28½	at	3	9	= 5	6	10½
		Total		£30	12	9 Ans.

3. As 10 men = 15 women, 1 man = 1½ women, and 8 men = 12 women, which added to the 6 actual women = 18 w. Having eliminated the men we have (24 d. × 15) ÷ 18 = 20 days. Ans.

STANDARD VI.

1. Bringing the different consumers to their equivalents in *one* of them—say girls, the lowest in the scale being generally the easiest—we have 40 men = 80 girls, 60 women = 96 girls, 90 boys = 120 girls, and these added to the 100 girls = 396 girls. The question is now simply,—If 16 girls consume 50 lbs. of beef in 11 days, how long would 1250 lbs. last 396 girls? Then by proportion—

$$\frac{11 \text{ days} \times 16 \times 1250}{396 \times 50} = 11\tfrac{1}{3} \text{ days. Ans.}$$

2. As he pays away ⅓ at last payment, and has £5 left, he must have had £10 *before* last payment, or *after* third payment. As the third payment was ⅔ of the money in hand, the £10 left must be ⅓ of what he had after third payment, hence he must have had £40 *before* third payment or *after* the second. This second payment being ⅜, the £40 must be ⅓; hence he had £120 after first payment. But this £120 must be ⅔ (as he paid ⅓) of what he had at first, then (£120 ÷ 2) × 3 = £180, amount to begin with; hence £180 − £5 = £175. Ans. Expressed concisely the original amount is £5 × $\frac{3}{2}$ × $\frac{4}{3}$ × $\frac{3}{2}$ × $\frac{3}{1}$ = £180.

3. £79$\frac{1}{12}$ = 38,200 halfpence; 2½d. = 5 halfpence. Hence $\frac{38200}{76400}$ = $\frac{1}{760}$ represents the fraction of the money spent, and consequently the fraction of the coal bought. Then $\frac{1}{760}$ of 115½ tons = $\frac{1}{760}$ of $\frac{461}{4}$ × $\frac{20}{1}$ = $\frac{461}{152}$ cwt. Ans.

STANDARD VII.

	£	s.	d.	
1. 25 guineas or £26 5s. × 18 =	472	10	0	rents due.
£472 10s. − 5 per cent. =	448	17	6	,, received.
£448 17s. 6d. − 7½ per cent. =	415	4	2½	net receipts.
£415 4s. 2½d. ÷ 87·5 (hund.) =	4	14	10$\frac{3}{7}$	Ans.

2. £22 10s. × 305 = £6862 10s. yearly receipts. As he gains 30 per cent., the goods that cost £100 sell for £130, hence the cost of the goods is $\frac{100}{130}$ = $\frac{10}{13}$ of their selling price, and the profit must be $\frac{3}{13}$, then $\frac{3}{13}$ of £6862 10s. = £1583 13s. 0$\frac{1}{11}$d. Ans.

3. £5980 ÷ 92 = 65 hundred of stock bought.
£4 × 65 = £260 interest from this stock.
£95 × 65 = £6175 received on selling out.
£6175 ÷ 127½ = 48$\frac{34}{51}$ hundred of 6 per cent. stock.
£6 × 48$\frac{34}{51}$ = £290$\frac{4}{17}$ interest from 6 per cent. stock.
£290$\frac{4}{17}$ − £260 = £30 11s. 9$\frac{3}{17}$d. increase. Ans.

CRYSTAL PALACE.—The award of Scholarships and Prizes to students in the Ladies' Division of the Crystal Palace School of Art, Science, and Literature was recently completed, when Mr. Edwin Long, R.A., Mr. Joseph J. Jenkins, F.S.A., R. Soc. P.W.C., and Mr. G. Elgar-Hicks adjudicated on the work of the students in the Art classes. The medal for water-colour painting (landscape, architecture, etc.) was given to Mrs. Edward Milner (née Miss Hamilton), the certificate to Miss S. E. R. Horton, to whom the scholarship in art was adjudged; the medal for water-colour painting from the life to Miss J. M. Bethune, the certificate to Miss Lina Newall; the prize for drawing from the antique to Miss M. Flood Page; the certificate for drawing from the life to Miss E. S. Norton. The scholarship in music has been adjudged to Miss Alice Ferrier; the scholarship in modern languages, literature, etc., to Miss Elsie Atkins.

Instructions to H.M. Inspectors.

THE Amended Code came into force on the 6th April, and as every school whose annual inspection is due after April 30th, 1883, will be subject to its provisions, teachers have anxiously looked for the publication of this promised Circular, which, it was understood, would contain specific regulations as to the conduct of the examination, as well as some more definite statements as to the meaning and application of certain articles of the Code. The document now issued will, in these and, we believe, in all other respects, prove generally satisfactory. The spirit which pervades it accords with the previously professed purposes of the Vice-president; and though the 'Mundella Code' is not all that teachers would desire, this Circular will doubtless tend to strengthen the faith of the profession, as well as of the public in general, in its probable beneficial results.

The inspectorate is now being reorganized. Sub-inspectors—a new class—are to act under district inspectors, who, grouped within certain territorial limits, will themselves be supervised by senior divisional inspectors. By 'mutual agreement' on the part of the senior inspectors there will be established a certain standard of examination for uniform application in all the schools of England and Wales. 'Occasional conferences' will be held for the purpose of comparing 'sums set and passages dictated,' etc., in order that uniformity of test may be maintained; for the standard determined upon must be 'faithfully observed in each district.' 'Startling differences' in the average percentages of adjoining districts are by these prudent arrangements not likely to exist in future, especially when all H.M. inspectors shall have effectively undergone the 'special training' prescribed henceforth as a preliminary to an appointment. The divisional inspector will hereafter personally attend to all proper appeals from the reports of district inspectors, should any such appeals be made.

This Circular is the necessary complement of the reorganization of the inspectorate in connection with the provisions of the New Code. Each of its forty-five sections demands careful examination by managers and teachers, especially by the latter, for whom many of the 'Instructions' are evidently designed. H.M. inspectors, for example, do not require to be officially told that 'it is often a help in calculation if the dimensions of the schoolroom, the playground, and the desks, and the weight of a few familiar objects are accurately known and recorded,' or to be informed that 'it is useful to mark on the floor of the schoolroom the meridian line,' and other matters of that sort.

But those 'Instructions' which relate to the official duties of inspectors are of an eminently practical character, and the details given tend directly to secure the universal application of one and the same standard of judgment. The great majority of the inspectors, it is generally acknowledged, have ever acted with impartiality, and the whole body of teachers would join with 'My Lords' in crediting them with great 'courtesy, patience,' and gentlemanly conduct. The second paragraph of the Circular indicates that there are at least complaints of the occasional absence of these virtues, and also of 'a want of due consideration in the treatment of teachers and scholars.' The want of 'sufficient time' is, no doubt, a frequent cause of the evils complained of, and the few unpunctual inspectors are urged in very intelligible terms to an 'early attendance,' in order to avoid that 'undue haste' which 'is incompatible with the proper discharge of your main duty.' Laws are not made for the righteous, and 'My Lords,' in insisting that there be no 'hurry' in conducting an examination, will cut off a chief source of discontent. The preferences or prejudices, and the special tastes or idiosyncrasies of examiners have occasionally called forth complaint, but the stringent regulations of this Circular will, if 'faithfully observed,' almost entirely eliminate the importance hitherto attached to the 'personal equation.' In the interests of education, as well as in the interests of justice, every district should be under one common influence, which should actuate teachers to work confidently towards one common result. When the reorganisation of the inspectorate has been completed, and when all its officers are experienced in their duties, we may venture to predict that under the new *régime* the senior inspector will have few 'appeals' to distract his attention from the more congenial work of stimulating true educational progress within the limits of his own division.

The marks 'Fair' and 'Good' are to be assigned generally on principles the justice of which will be readily accepted. At least fifty per cent. of the scholars must pass to gain the former mark, and seventy-five per cent. to win the latter. This general 'scale' applies particularly to the 'class' and specific subjects. In small schools, and in some others, teachers will, with regret, find it, in most cases, impossible to include any of the 'specifics' in their course of instruction. The reasons which have determined this virtual exclusion will be studied with care. Where the upper standards are numerous, specific subjects 'may be encouraged,' but 'My Lords' have no intention 'to encroach in any way on the province of secondary education.' The Sixth Standard is even now often reached at twelve years of age, and an increasing number of scholars will in many schools reach the Seventh Standard young enough to require provision for extra instruction in the day-school. The possible introduction of class and specific subjects into the 'varied teaching' of evening schools will tend to revive many such schools that are now languishing, and to create many others, to the great intellectual and moral benefit of the country. The exclusion of 'specifics' will nevertheless be felt in some small day-schools.

The regulations for presentation and for re-presentation on the day of inspection seem to be justly and generously interpreted. No scholar will fail in writing and arithmetic on account of a disabled hand or loss of eyesight, etc. 'Delicate health, obvious dulness, and defective intellect' will probably include all the additional cases which teachers would desire to withdraw from the examination, and 'reasonable excuses' for the absence of scholars will be readily allowed. Since, at present, managers mostly measure success by the percentage of passes; and as this amount, multiplied by the average attendance, will determine the greater part of the Government grant, the reputation and, not unfrequently, the income of the teacher will largely depend upon the magnitude of each of these important factors. Thus temptations to teachers still exist, but their force is not so direct as before. Should the integrity of any teacher seem to yield under pressure, the Code now happily provides that

no penalty shall be inflicted without giving the accused an opportunity of personal explanation. The suspension of a certificate will be esteemed by the profession a mild punishment for one who is convicted of deliberate and systematic falsification of the registers or of any kind of school returns. 'Special care on the part of managers, and watchfulness' on the part of inspectors are strictly enjoined in view of the altered basis on which the grant is made; but we believe that cases of 'tremendous fraud,' though not numerous in the past, will be still fewer in the future. There ought to be no more honourable men in any state than those who have to mould the character of its youth.

Severe as the Department will justly be upon every proved instance of 'false registration,' there is reason to believe that, on the other hand, local authorities who are careless as to the attendance of children at school will be visited with at least equal severity. 'Cases of gross neglect on the part of the authorities should form the subject of a special report to the Department.' Irregularity due to such neglect is to modify H.M. Inspectors' 'judgment of the school.' Neither teachers or managers can be fairly held responsible when, as is now too often the case, attendance committees entirely fail in the discharge of their duties. It was the beginning of a new epoch in the history of this country, when, in 1876, Mr. Forster placed as the first clause of an Act of Parliament, the pregnant declaration:—'It shall be the *duty* of the parent of every child to cause such child to receive efficient elementary instruction in reading, writing, and arithmetic; and if such parent fail to perform such duty, he shall be liable to such orders and penalties as are provided by this Act.' Local authorities are not only bound to make known this 'legal obligation,' but also to enforce it. The Education Department appears to be earnestly resolved to see that these duties shall not be lightly disregarded. The enforcement of the law will materially contribute to the comfort of teachers as well as to the benefit of the children.

This remarkable Circular on the administration of the Code, whilst seeming to demand the highest possible results of instruction, nevertheless contains many passages which urge H.M. inspectors to make 'reasonable allowance for special circumstances.' Some subjects, like cookery, in girls' schools, *must* be taught by a 'duly qualified teacher'; and 'a special teacher' of specific subjects is suggested for 'groups of schools' where such an arrangement is possible. 'Good teachers' are to be allowed greater freedom of choice as to 'class' and 'specific' subjects; to the '*quality* of the instruction' is to be attached 'increased weight,' and on every page there are plain indications that the Department is anxious that the very best type of school suited to any given locality should there be established. Paragraph 32 points out the general conditions on which 'a thoroughly good school' may obtain the mark of 'distinguished merit,' and be reported as 'excellent.' These conditions are numerous, and can only be satisfied by a large expenditure on the part of the managers, and by superior ability on the part of the head teacher and the rest of the staff. 'It is hardly to be expected that any one school will completely satisfy all these conditions,' but it is well that there should be a lofty ideal to contemplate. 'Above all'—this is the crowning point—'its teaching and discipline are such as to exert a right influence on the manners, the conduct, and character of the children —to awaken in them a love of reading, and such an interest in their own mental improvement as may reasonably be expected to last beyond the period of school-life.

The tendency of the Revised Code of 1861 was to make teaching mechanical, and one of H.M. inspectors, in comparing it with the Minutes previously in operation, gave, as reasons for its 'superior nature,' the 'all but absolute certainty upon, at all events, the attainments required,' and the power 'to apply praise or blame with an amount of firmness and precision which, under the former Code, I was unable to do' (Minutes, 1866-7. Vol. i., p. 16). Educationists, however, felt that that Code was defective in not recognising some results which they deemed of greater importance than the three R's, and the merit grant of the New Code is a concession to their oft-repeated remonstrances. The inspector himself must assess this grant, and 'there is no graver or more difficult task' imposed upon him in the round of his official duties. If he is guided by the 'passes' alone, the majority of schools will obtain the mark 'good'; the average at present is 82·6, or seven per cent. above the required number. But a generous regard to the *quality* of instruction, and the other elements of excellence, so graphically enumerated in section 32, as well as to the difficulties with which some schools have to struggle, will further increase the proportion. 'Deductions by tenths' may still occur, but the steady growth of correct sentiments as to the value of true education to the individual and to the nation will ultimately secure, even for the smallest school in the kingdom, an efficient staff, and the 'mark of distinguished merit' more frequently than the fines which have been often due to defective management. The power of inspectors is, doubtless, very much enlarged. Their 'estimate of the merit of the school as a whole' should 'be the result of several factors of judgment,' and must depend upon their judgment of factors. With more exact rules for guidance errors are possible, and grounds for the award of 'fair,' 'good,' or 'excellent,' need not be given. Infants' schools are, perhaps, most liable to be misjudged with reference to the merit grant, which in their case is a more important item of income. Teachers generally will care far more for their reputation than for the finance, as in the majority of schools the extra shilling will not make a very serious difference in the total amount.

But nothing human is perfect. The New Code has already been amended.* As time progresses further revision will be needed. The Earl Spencer and Mr. Mundella availed themselves of the practical wisdom of the country in drawing up the Code, and in the Circular before us the intentions of the Department are more fully expressed. If, in the administration of the 'regulations,' the spirit which dictated these 'Instructions' shall be universally predominant among the inspectors, the discharge of 'new duties,' 'delicate and onerous' as they are, will be accompanied with 'carefulness, insight, and sympathy' 'in a higher degree than ever.' Managers will be stimulated to a more ready co-operation, and teachers, conscious of a real and sympathetic support, will labour with greater hope for the benefit of their country. The 'Mundella Code' was an advance on its predecessors; the Instructions make it better still.—*Majora canamus.*

* Art. 109 has been amended, so that (f.) (i.) 5 omits '*in mixed schools*;' and (f.) (vi.) therefore provides that all 'girls [in any school] may take needlework as their second "class" subject.'

Instructions to Her Majesty's Inspectors.

CIRCULAR No. 212.

Education Department, Whitehall. August, 1882.

SIR,—1. The changes which have recently been introduced into the Code, and the proposed reorganisation of the work of inspection, entail a review of the instructions given in some previous circulars for the guidance of inspectors in their inspection and examination of schools.

Examination and Inspection Generally.

2. Before entering into details of principles and methods of examination, my lords would especially call your attention to the general principle, that all hurry or undue haste on the day of examination, is incompatible with the proper discharge of your main duty—that of ascertaining, verifying, and reporting the facts on which the Parliamentary grant is administered. Their lordships gladly acknowledge the great courtesy, patience, and industry with which the inspectors have, as a body, discharged the difficult duty of collecting the numerous particulars required for an accurate judgment of each scholar's work in detail, and of the school as a whole. But instances have occurred in which managers have complained of unpunctuality, haste, and impatience, and of a want of due consideration in the treatment of teachers and scholars. It may be fairly inferred that such complaints would not arise if sufficient time were given to each inspection. An early attendance at the school is absolutely indispensable, not only on account of the greater length of time available for work, but in the interests of the children, who are far more capable of sustained exertion in the early part of the day. A hurried inspection probably necessitates some evils, which are much to be deprecated—the attempt to do two things at once, *e.g.*, to give out dictation or sums while hearing the reading of another class; keeping classes unemployed instead of dismissing them to play; retaining children in school in the dinner hour and thereby not allowing sufficient time for the meal; prolonging the examination to a late hour in the afternoon; and embarrassing young scholars by want of clearness in dictation or in asking questions.

Uniformity of Standard.

3. It is not necessary in this circular to enter into minute details as to the rules to be observed in examining schools. It may be expected that practical uniformity will be obtained by the arrangements recently made for conference and agreement on the part of the senior inspectors, whose duty it will be to see that the rules approved by the Department are uniformly observed by the district inspectors in their respective divisions. My lords do not propose to interfere with the methods by which each inspector may prefer to arrive at results, but will expect that the standard obtained by the mutual agreement of the senior inspectors, and approved by their lordships, shall be faithfully observed in each district. For this purpose occasional conferences will be held in each division with a view to compare sums set and passages dictated in each standard, questions asked in class or specific subjects, and the methods and results of inspection generally. Uniformity of standard will also be further secured by the proposed special training of all inspectors who may hereafter be appointed.

Appeals.

4. Appeals from the reports and recommendations of inspectors have not been frequent in the past, and will probably be even less frequent in future, when a uniform standard of examination is applied throughout the districts. But if any complaint of real or apparent hardship should be laid before the Department, the case will be referred by their lordships to the senior inspector of the division for personal inquiry and report, wherever the facts alleged seem to justify such a reference.

Infants' Schools and Classes.

5. Under Article 106 of the Code, the entire grant to an infants' school or class will be computed on the average attendance, and not as heretofore, in part, on the number of children present on the day of inspection, and on the number of passes obtained in the standard examination. The children, apparently above six, should, however, be individually examined, and a sufficient number of the others to satisfy you that the elements of reading, writing, and arithmetic, are properly taught. The Code assumes that, besides suitable instruction in these elements, and in needlework and singing, a good infants' school should provide a regular course of simple conversational lessons on objects, and on the facts of natural history, and a proper variety of physical exercises and interesting employments. In the best schools, the list of collective lessons is prepared by the head-teacher three months in advance, and is entered in the log-book. The managers of a school in two or in three departments are at liberty to place the scholars of Standard I.—usually between seven and eight years of age—either in the infants' department, or with the older children; but when the former plan is preferred, the course of lessons should include simple recitation and lessons in geography or elementary science, to correspond to the class-subjects intended to be taken up in the boys' or girls' school. It should be borne in mind that it is of little service to adopt the 'gifts' and mechanical occupations of the Kinder-Garten unless they are so used as to furnish real training in accuracy of hand and eye, in intelligence, and in obedience.

Award of Grant.

6. An infants' school or class may be deemed 'Fair' when more than half of the scholars examined prove to have been satisfactorily taught in reading, writing, and arithmetic; when discipline and singing are fairly good; and when one of the requirements specified under (2) and (3) in Article 106*b** is fairly fulfilled. When both of those requirements are fairly fulfilled; when not less than three-fourths pass the individual examination well; and when discipline and singing are satisfactory, the mark 'Good' should be awarded. A school or department should not be called 'Excellent' unless all three requirements of the article are thoroughly well satisfied. No merit grant should be given in any case in which the infants' class is left in the sole charge of a monitor. The time-table should show what portion of the daily instruction is given by the head or some other adult teacher.

Standard Subjects.—Reading.

7. The Code requires that in all standards higher than the second three reading books shall be provided. More than three sets of books are not necessary in any standard; an ordinary reading book will provide a sufficient amount of good literature for exercises in the art of reading and for all the purposes of teaching 'English' if taken as a class subject: in the third and higher standards the second reading book will be a historical reader; the third book will be a geographical or scientific reader, to correspond to the second-class subject. In schools in which no second-class subject is taken, the third book may be, like the first, an ordinary reader. In Standards I. and II. two ordinary reading-books may be used, unless the managers prefer that the second book should be a geographical or scientific reader, to suit the second-class subject. In Standards V., VI., and VII. books of extracts from standard authors may be taken, though such works as 'Robinson Crusoe,' Voyages and Travels, or Biographies of eminent Men (if of suitable length) are to be preferred. In Standards VI. and VII. a single play of Shakespeare, or a single book of one of Milton's longer poems, or a selection of extracts from either poet equal in length to the foregoing, may be accepted. As a rule, ordinary text-books or manuals should not be accepted as readers.

8. In Standards I. and II. intelligent reading will probably suffice to justify a pass without much examination into the matter of the book; but it should be considered a grave fault if children have been allowed to read the same lesson so often as to learn it by heart, and to repeat it without any but occasional glimpses at the book. The mechanical difficulties of reading, which are to be found in the shorter words of irregular notation, should be mastered before Standard III. is reached. As a general rule, but especially in the lower standards, the examiner should be careful rather to ask for the meaning of short sentences and phrases than to require explanations of single words by definitions or synonyms.

Writing.

9. In Standard I. the writing exercises should, as a rule, be done on slates, and should be regarded chiefly as a test of *handwriting*, *i.e.*, of the child's power of making and combining script letters (small and capital), and accurately transcribing print. My

* Art. 106 (*b*): 'A merit grant of 2s., 4s., or 6s., if the inspector reports the school or class to be fair, good, or excellent, allowing for the special circumstances of the case and having regard to the provisions made for (1) suitable instruction in the elementary subjects, (2) simple lessons on objects and on the phenomena of nature and of common life, and (3) appropriate and varied occupations.'

lords do not pledge themselves to any particular style of writing or method of teaching it, but it should at least be bold and legible, and the text adopted should be sufficiently large to show that the child is acquainted with the proper forms and proportions of letters. In dictation none but the easiest and most familiar words, and those chiefly monosyllables, should be given out, and a pass should not be withheld if six out of the prescribed ten are correctly spelt and written. In Standard II. the exercises should be on slates, security for writing on paper being provided by the exhibition of copybooks. The same qualities of writing should be required as in Standard I., but greater importance should be attached to evenness and uniformity, and to proper spaces between the words. Capitals should be required to be put without direction after full stops and at the beginning of proper names. The passage for dictation should be carefully selected as being of average difficulty, and free from puzzling words. As children may generally be expected to pass easily in the mechanical art of writing at this stage, five mistakes in spelling ought, as a rule—if the passage selected be sufficiently easy—to involve a failure. In Standard III., and those above it, the examination should always be on paper. Greater readiness should be expected in writing, but two or three words only should be dictated at once. As a rule, more than four errors in spelling should involve failure; but, if the handwriting be *very fair*, and not more than four errors in spelling occur in the six lines, the child should pass. Correct spelling should not, in any case, obtain a pass if the writing is below *fair*. In Standard IV., and those above it, writing should be running, free, and symmetrical, as well as legible and clear. If poetry is selected for dictation, the scholars should be made clearly to understand before beginning to write where each line commences and ends. A pass should not be withheld if the writing is *fair*, and the errors in spelling do not exceed three.

10. In Standard V. the passage selected for writing from memory should be an anecdote occupying from ten to fifteen lines of ordinary length, and containing some sufficiently obvious *point*, or simple moral. The passage may, if the teacher desires, be read out aloud by him. Neither accuracy in spelling nor excellence in writing should secure a pass, unless the exercise is an intelligent reproduction of the story. The writing exercise prescribed for Standard V. may be altogether, and must be to a certain extent, an effort of memory: that for Standard VI. is the earliest exercise in composition required in the Code as part of the writing exercise; and no child ought to pass who does not show the power to put together in grammatical language, correctly expressed, and, if required, in the form of a letter, a few simple observations on some easy subject of common and familiar experience. In Standard VII. in order to warrant a pass the theme should exhibit something more of structural character and arrangement, the sense should be clear, the expressions fairly well chosen, and the writing, spelling, and grammar free from ordinary faults.

11. In all cases where a dictation exercise is given, the teacher may be permitted, if he desires, to read the passage over to the children before it is dictated by the inspector. In Welsh-speaking districts the teacher may be allowed to give out the whole of the dictation.

Arithmetic.

12. Little change has been made in Schedule I. in regard to the requirements under the head of Arithmetic. You will probably continue the usual practice of setting in all standards above the first, four sums, of which not more than one should be a problem, and of permitting a scholar to pass who has two correct answers. Right method and arrangement and good figures may excuse slight error in one of the answers. In Standard V. the 'rule of three by the method of unity' has been prescribed in order to avoid at that stage the difficulties of the theory of proportion, and to suggest a simpler method of solving ordinary problems by a combination of the four simple and compound rules. But if the answers are correct, and have been intelligently worked by either method, you will of course accept them.

13. Mental arithmetic is a new requirement, but is not intended to form an addition to the individual examination for the purpose of recording the 'passes' in the schedule. It is a class exercise, and may often be satisfactorily tested by requiring the teacher of the class to give a few questions in your presence, and by adding at discretion some questions of your own. The object of this exercise is to encourage dexterity, quickness and accuracy in dealing with figures, and to anticipate, by means of rapid and varied oral practice with small numbers, the longer problems which have afterwards to be worked out in writing. It is obvious that this general object cannot be attained if the exercises are confined to a few rules for computing 'dozens' and 'scores,' such as are often supposed to be specially suited for mental calculation. Practice should be given in all the ordinary processes of arithmetic; *e.g.*, in Standard I., addition, subtraction, and multiplication, with numbers up to 50 and money up to 2s.; in Standard II., all the four rules, with numbers up to 144, and with money to 10s.; in Standard III., easy reductions; and, in Standard IV., simple exercises in fractions founded on the multiplication table, and on the aliquot parts of £1, of a yard, and of a pound avoirdupois. It is often found a help in calculation if the dimensions of the schoolroom, the playground, and the desks, and the weight of a few familiar objects are accurately known and recorded, and occasionally referred to as standards of measurement.

Class Subjects.

14. In reporting on the subjects of grammar, geography, and history you have been required hitherto simply to state whether the whole grant ought to be awarded or disallowed. You will, in future, report whether a grant should be made, and, if so, whether the results of the instruction are 'fair' or 'good.' The mode of examining is left to your discretion, and may be usefully varied from year to year. It is often advisable to invite the teacher of the class to put a few questions in order that you may know what plan the has adoped before proceeding to propose questions of your own. In standards above the third the knowledge of the scholars may sometimes be tested by written answers, which you will carry home and examine; but you will generally be able to satisfy yourself by means of oral questions addressed separately to a sufficient number of the scholars, whether the class has been properly taught. The quality of the answers, as well as the number, will have to be considered, and the knowledge of the subject should be fairly distributed throughout the various standards. But, subject to these considerations, it is a safe general rule that the result may be marked 'good' when three-fourths of those examined are found to have been well taught, and 'fair' when one half of them prove to have been so taught. If this latter condition be not fulfilled, no grant should be recommended under Article 109 *f*.

15. Both in class and in specific subjects the Code permits a certain liberty of choice to managers, and it is no part of your duty to restrict this liberty. But if your advice is asked it will be well in giving it to have regard to the special qualifications of the teacher, and to the opportunities and means at hand for scientific or other instruction. Other conditions being equal, any teacher will be likely to teach best the particular subject of which he knows most, and in which he takes the strongest interest.

Grouping of Standards.

16. When the numbers in the upper division of the school as defined in Article 109 *f*. iii. do not exceed 30 at the beginning of the school year, the children of that division may be treated as one class for instruction in class-subjects. When the numbers exceed 30, the upper division should be divided into two groups at least. The grouping of standards is intended to work as follows:—Supposing the 4th and 5th Standards to form one group, and the 6th and 7th another, the former group will be required to take the work of the 4th and 5th Standards in alternate years, the latter that of the 6th and 7th standards in alternate years. If the four Standards—IV.-VII.—are placed in one group, they will take the subjects of each standard in turn.

English.

17. The examination in this subject is not, as you will observe, limited to technical grammar, although parsing and analysis still form an important part of the requirements. The general object of lessons in English should be to enlarge the learner's vocabulary, and to make him familiar with the meaning, the structure, the grammatical and logical relations, and the right use of words. Elementary exercises of this kind have an important practical bearing on everything else which a child learns. The recitation of a few verses of poetry has been prescribed in every standard, and it will be the duty of a teacher to submit to you for approval on the day of inspection a list of the pieces chosen for the ensuing year. It is not necessary that the required number of lines should be taken from one poem; they may be made up from two or more, provided that each extract learned by heart has a completeness and value of its own, and is understood in relation to the story or description of which it forms a part. The extracts should be simple enough to be pleasing and intelligible to children, yet in Standards III. and upwards sufficiently advanced to furnish material for thought and explanation, to improve the taste, and to add to the scholar's store of words. In testing the memory lesson it may suffice to call on a few of the children—

not less than one-fourth in each class—to recite each a few lines in succession, and occasionally it may be useful to require the verses to be written down from recollection.

18. From the first, the teaching of English should be supplemented by simple exercises in composition; *e.g.* when a word is defined, the scholar should be called on to use it in a sentence of his own; when a grammatical principle is explained, he should be asked to frame a sentence showing how it is to be applied; and examples of the way in which adjectives are formed from nouns, or nouns from verbs, by the addition of syllables, should be supplied or selected by the scholars themselves. Mere instruction in the terminology of grammar, unless followed up by practical exercises in the use of language, yields very unsatisfactory results.

Geography and Elementary Science.

19. The Code recognises as the means of instruction in geography and elementary science, reading books, oral lessons, and visible illustrations. But it does not prescribe the exact proportions in which these means shall be employed for each standard, and for each subject. Those proportions should be determined partly by the special plans and aptitude of the teacher, and partly by other considerations. In Standards I. and II. it will not be necessary for you to insist on the use of a reading book, if provision is made for meeting the requirements of the Code by a systematic course of collective lessons of which the heads are duly entered in the log-book. The best reading books for higher standards are those which are descriptive and explanatory, are well written and suitably illustrated, and contain a sufficient amount and variety of interesting matter. When these conditions are fulfilled, and the reading lessons are so supplemented by good oral teaching as to enable the scholars to pass the prescribed examination well, the requirements of the Code will be satisfied, even though the course of lessons in the reading book does not correspond in all respects to the year's work of a particular standard.

20. In teaching geography, good maps, both of the county and of the parish or immediate neighbourhood in which the school is situated, should be affixed to the walls, and the exact distances of a few near and familiar places should be known. It is useful to mark on the floor of the schoolroom the meridian line, in order that the points of the compass should be known in relation to the school itself, as well as on a map.

Singing.

21. The full grant for singing is not now to be claimed unless the scholars are so taught as to be able to 'sing by note.' You will be furnished in subsequent instructions with some simple testing exercises by which to determine whether this condition has been properly fulfilled. The regulations under which a grant has hitherto been given for singing will still apply in cases in which the children have been taught by ear only. A list of six or eight pieces should be presented, from which you will select one or more in order to judge whether the children have been 'satisfactorily taught' or not.

Needlework.

22. It will be seen that considerable reductions have been made in the amount of work required in needlework, and that the obligatory parts of Schedule III. now contain no more work than can be fairly mastered by any girls' school in which four hours weekly have been devoted to this subject. If any school fails to earn the grant it will probably be found that such failure is due to bad teaching in the lower standards, or that the subject has not been taught (as all the other subjects are taught, and as needlework should be taught) to classes as well as to individuals.

23. No just progress can be made in the general teaching of needlework in a school without effective simultaneous teaching throughout the classes, and it will be the duty of the inspector specially to inquire into the needlework of infants, and of the lowest standards in other schools.

24. Where any uniform failure in the teaching of these classes occurs you will report, even when a grant is not claimed for needlework, that the subject is not properly taught; and it may be well to point out to the managers that a few specimens of garments from the best children do not compensate for imperfect teaching in the lower classes.

25. You will in all cases, as heretofore, examine the articles which the children have made during the year; and will satisfy yourself of the genuineness of the specimens by requiring some of the scholars to perform a simple exercise on the day of examination, whether a grant is claimed for needlework under Article 109*c*. or not. In order to ascertain that the teaching has been in accordance with the schedule, it will be needful to require a sufficient number of the scholars in two or more standards to work specimens of sewing or knitting in your presence. Detailed rules for the conduct of this part of the examination will be found in Appendix I. When needlework is selected as a class subject, you will not recommend the higher grant of 2s. unless the results of the teaching are clearly 'good.' The lower grant of 1s. may be obtained by the same degree of proficiency as will be required for the grant of 1s. under Article 109*c*.

Specific Subjects.

26. You will observe that specific subjects cannot be taken up before a scholar has passed the Fourth Standard; and that English, Geography, including Physical Geography, History, and Elementary science are recognised as class subjects. If these subjects are simply and thoroughly taught the scholars will form those habits of exact observation, reasoning, and statement which are needed for the intelligent conduct of life. In ordinary circumstances the scheme of elementary education, as now laid down by the Code, may be considered complete without the addition of specific subjects. It is not desirable, as a general rule, that specific subjects should be attempted where the staff of the school is small, or the scholars in Standards V.—VII. do not form a class large enough to justify the withdrawal of the principal teacher from the teaching of the rest of the school: in this latter case they would derive more benefit by being grouped with Standard IV. for class subjects. The pecuniary loss entailed by the exclusion of a few boys from the study of specific subjects will be abundantly compensated by the greater success in other subjects, and especially by the higher merit grant reserved for more thorough teaching generally.

27. In large schools, however, and those which are in favourable circumstances, the scholars of Standard V. and upwards may be encouraged to attempt one or more of the specific subjects, which the managers may deem most appropriate to the industrial and other needs of the district. It is not the intention of my lords to encourage a pretentious or unreal pursuit of higher studies, or to encroach in any way on the province of secondary education. The course suited to an elementary school is practically determined by the age limit of fourteen years; and may properly include whatever subjects can be effectively taught within that limit. It may be hoped that year by year a larger proportion of the children will remain in the elementary schools until the age of fourteen; and a scholar who has attended regularly and possesses fair ability may reasonably be expected to acquire in that time not only a good knowledge of reading, writing, and arithmetic, of English, and of Geography, but also enough of the rudiments of two higher subjects to furnish a stable foundation for further improvement either by his own exertion or in a secondary school.

28. In cases in which it is proposed to teach specific subjects, it will be desirable for you to ascertain that the teacher has given proof of his fitness to teach them by having acquitted himself creditably at a training college, or at some other public examination. You will often find that these subjects are most thoroughly taught when a special teacher is engaged by a group of schools to give instruction in such subjects once or twice a week, his teaching being supplemented in the intervals by the teachers of the school. You will judge of all schemes of elementary science which may be submitted to you for approval by their applicability to the school stay of the bulk of scholars, remembering that the whole course of study is primarily designed for those children who go to labour after they have reached the full time standard.

Merit Grant.

29. There is no graver or more difficult task imposed upon Her Majesty's Inspectors by the amended Code than that of assessing the merit grant. Your own experience must often have led you to conclude that the full value of a school's work is not accurately measured by the results of individual examination, as tabulated in a schedule; and that two schools, in which the ratio of 'passes' attained is the same, often differ materially in the quality of those passes, and in general efficiency as places of education. It is in order that these differences may be duly recognised in calculating the grant that my lords have caused the award of a substantial part of that sum to be dependent on the estimate you form of the merit of the school as a whole. Article 109b. specifies three particulars: (1) the organisation and discipline; (2) the intelligence employed in instruction; and (3) the general quality of the work, especially in the elementary subjects. Thus the award of the merit grant will be the result of several factors of judgment. The quality as well as the number of passes will necessarily rank as the most important of these factors; but inferences derived from them alone may be modified by taking into account the skill and spirit of the teaching, the neatness of

the schoolroom and its appliances, the accuracy and trustworthiness of the registers, the fitness of the classification in regard to age and capacity, the behaviour of the children, especially their honesty under examination, and the interest they evince in their work. The Code also instructs you to make reasonable allowance for 'special circumstances.' A shifting, scattered, very poor or ignorant population; any circumstance which makes regular attendance exceptionally difficult; failure of health, or unforeseen changes among the teaching staff, will necessarily and rightly affect your judgment. It is needful, however, in all such cases, to have regard not only to the existence of special difficulties, but also to the degree of success with which those difficulties have been overcome.

Schools not Entitled to Merit Grant.

30. From bad or unsatisfactory schools it is manifest that the merit grant should be withheld altogether. The cases which you dealt with under Article 32b. of the former Code, and in which a deduction of one or more tenths was made for 'faults of instruction or discipline,' or in which you have not recommended the grant for 'discipline and organisation,' would of course fall under this head. Other cases will occur which are not serious enough to justify actual deduction; but in which you observe that there is a preponderance of indifferent passes, preventible disorder, dulness or irregularity; or that the teacher is satisfied with a low standard of duty. To schools of this class no merit grant should be awarded.

Fair Schools.

But a school of humble aims, which passes only a moderately successful examination, may properly be designated 'Fair,' if its work is conscientiously done, and is sound as far as it goes; and if the school is free from any conspicuous fault.

Good Schools.

31. Generally, a school may be expected to receive the mark 'Good,' when both the number and the quality of the passes are satisfactory; when the scholars pass well in such class subjects as are taken up; and when the organisation, discipline, tone and general intelligence are such as to deserve commendation.

Excellent Schools.

32. It is the intention of their lordships that the mark 'Excellent' should be reserved for cases of distinguished merit. A thoroughly good school in favourable conditions is characterised by cheerful and yet exact discipline, maintained without harshness and without noisy demonstration of authority. Its premises are cleanly and well ordered; its time-table provides a proper variety of mental employment and of physical exercise; its organisation is such as to distribute the teaching power judiciously, and to secure for every scholar—whether he is likely to bring credit to the school by examination or not—a fair share of instruction and of attention. The teaching is animated and interesting, and yet thorough and accurate. The reading is fluent, careful, and expressive, and the children are helped by questioning and explanation to follow the meaning of what they read. Arithmetic is so taught as to enable the scholars not only to obtain correct answers to sums, but also to understand the reason of the processes employed. If higher subjects are attempted the lessons are not confined to memory work and to the learning of technical terms, but are designed to give a clear knowledge of facts, and to train the learner in the practice of thinking and observing. Besides fulfilling these conditions, which are all expressed or implied in the Code, such a school seeks by other means to be of service to the children who attend it. It provides for the upper classes a regular system of home exercises, and arrangements for correcting them expeditiously and thoroughly. Where circumstances permit, it has also it lending library, its savings bank, and an orderly collection of simple objects, and apparatus adapted to illustrate the school lessons, and formed in part by the co-operation of the scholars themselves. Above all, its teaching and discipline are such as to exert a right influence on the manners, the conduct, and the character of the children, to awaken in them a love of reading, and such an interest in their own mental improvement as may reasonably be expected to last beyond the period of school life.*

33. It is hardly to be expected that any one school will completely satisfy all these conditions, and it is impossible that in the course of a single visit of inspection your attention should be directed to so many particulars. But it will be well to keep all of them in view in forming your own standard of what the best schools should aim at; and my lords do not wish the mark 'Excellent' to be given to any school which falls short of that standard in any important respects, or which is not, in some of them at least, entitled to special praise.

34. The responsibility of recommending the merit grant will in every case rest upon the inspector, and should not be delegated to an assistant. My lords do not require that you should state in fuller detail than you think desirable in your report on a school your reasons for designating it as 'Fair,' 'Good,' or 'Excellent;' but in all cases in which you recommend that the grant should be withheld, the grounds on which you do so should be briefly stated for the information and guidance of the managers.

Punishments.

35. My lords regret to receive frequent complaints of the excessive use of corporal punishment in schools, and of its occasional infliction by assistants and pupil-teachers, and even by managers. The subject is one on which your own observation is necessarily incomplete, since children are not likely to be punished in your presence on the day of inspection. But you will not fail in your intercourse with teachers and managers to impress upon them that the more thoroughly a teacher is qualified for his position by skill, character, and personal influence, the less necessary it is for him to resort to corporal chastisement at all. When, however, the necessity arises, the punishment should be administered by the head-teacher, and an entry of the fact should, in their lordships' opinion, be made in the log-book.

Registration.

36. In view of the fact that the grant made to a school is mainly calculated on the average attendance, accurate registration of admission, progress, and attendance continues to be of essential importance, and will require special care on the part of managers and watchfulness on your own. In Appendix II. you will find a revised edition of the official rules, which have been long in force for the proper keeping of registers, and it will be well to call the special attention of managers and teachers, especially in new schools, to the details set forth in that Appendix.

Irregularity of Attendance.

37. It must be clearly understood that irregularity of attendance, unless it is produced by some of the causes which constitute a reasonable excuse for absence, cannot be accepted as an excuse for the want of progress of any scholar. It has now become the interest of all concerned in the pecuniary results of the annual examination to increase the average yearly attendance by diminishing daily irregularities; but it may be hoped that higher motives will prompt all interested in education to press upon those entrusted with the execution of the law the actual legal obligation by which all parents are bound to present their children at the beginning of each meeting of the school. Cases of gross neglect on the part of the authorities, if brought to your notice, should form the subject of a special report to the Department. In your general judgment of the school, you will be careful to make allowances for all such neglect if the managers and teachers cannot be held responsible for it.

Excuses for Non-attendance on the Day of Examination.

38. The Code requires—

I. That all scholars whose names are on the registers of the school must be present at the inspection, unless there is a reasonable excuse for their absence.

II. That all such scholars whose names have at the end of the school year been on the register for the last 22 weeks during which the school has been open must be presented to the inspector for examination.

39. Hitherto, since part of the grant was based upon the individual payment for the successful examination of all scholars who had attended 250 times in the course of the year, managers were interested in getting together all such scholars on the day of inspection. As the grant is now based upon the average attendance of all the scholars, and will be adversely affected by the failure in examination of backward scholars, it will be your duty to see that every child who is liable to be presented for

* Your attention may be usefully recalled to the following extract from the Code of 1881:—

'The inspector will bear in mind, in reporting on the organisation and discipline, the results of any visits without notice made in the course of the school year; and will not interfere with any method of organisation adopted in a training college under inspection if it is satisfactorily carried out in the school. To meet the requirements respecting discipline, the managers and teachers will be expected to satisfy the inspector that all reasonable care is taken, in the ordinary management of the school, to bring up the children in habits of punctuality, of good manners and language, of cleanliness and neatness, and also to impress upon the children the importance of cheerful obedience to duty, of consideration and respect for others, and of honour and truthfulness in word and act.'

examination is present, unless there is a reasonable excuse on the day of examination, and to record the absent scholars on the schedule as if they had been present and had failed. If the number of absentees be large, the absences should be a positive disqualification for the mark 'good' or 'excellent' in assessing the merit grant. Among reasonable excuses, probably the most general will be found to be infectious disease in the home, storms, unavoidable absence from home, a death in the family, or the scholar's having left the neighbourhood. Beyond these it is not probable that many reasonable excuses will be found, though cases of an exceptional character may arise, and can only be decided on the day of inspection.

Withholding Children from Examination.

40. Many well-founded complaints have been made of undue pressure on backward scholars by keeping them in after school, by long home lessons, or by an injudicious use of emulation. The fact that a reasonable allowance may now be made for exceptional cases under Article 109*e* iii. will, it may be hoped, diminish this evil. Irregularity of attendance cannot be considered as a valid reason for withholding a child from examination, and managers of schools should refuse to countenance this plea, and should co-operate with all concerned in promoting greater regularity of attendance. The following excuses may, however, be reasonably accepted for withholding a scholar:—Delicate health or prolonged illness; obvious dulness or defective intellect; temporary deprivation, by accident or otherwise, of the use of eye or hand. But in order that all scholars whom it is proposed to withhold may not be neglected by a teacher, it will be your duty to look carefully through the list of such scholars, and to form a personal judgment as to the reasonableness of the excuses.

Re-presentation in the same Standard.

41. As a general rule, all scholars who have failed at the previous examination in any standard in two subjects may be presented a second time in that standard. The fact of such failure can be attested in the case of scholars who were in the school at the previous examination by means of last year's schedule, which will be before you. In the case of children coming from other schools, there may be difficulty in obtaining evidence of the highest standard previously passed; but, as a general rule, it should be presumed that such children, if above ten years of age, have passed Standard III., and all exceptions to this rule should be held to require explanation.

Cookery.

42. In all schools the grant for cookery, § 109 (*g*.) ix., should be conditional on the provision of special, adequate, and suitable arrangements for the practical instruction of the girls by a duly qualified teacher, in a room (which may be an ordinary class-room) fitted up with the necessary appliances. In schools, the circumstances of which admit of it, demonstration lessons in cookery should be given at frequent intervals by a professional person.

Pupil Teachers.

43. It is a fact deplored by all connected with the examination of candidates for admission to training colleges, and by all who have to instruct our future teachers in these colleges, that many pupil-teachers, at the close of their engagements, should possess so scanty a knowledge of arithmetic, geography, grammar, and history. Unless it is supposed that the great bulk of their teachers have neglected their instruction, the school work must obviously have pressed so heavily upon these young persons as to leave very little time for their improvement. It is admitted that boys and girls of sixteen or seventeen years of age should not spend more than eight hours daily in intellectual labour, and it cannot be thought an unnecessary requirement that out of this weekly maximum of forty hours (allowing for two half-holidays), ten hours should be reserved for the private studies of the pupil-teachers, over and above the five hours already prescribed for their instruction or examination by the teacher of the school. The new form of Memorandum of agreement (Schedule VI.) requires no more than twenty-five hours per week of actual service in teaching. When the work of the school is carried on for more than twenty-five hours, the time-table should be so arranged as to give the pupil-teacher the remaining time for private study in the school or class-room under the direction of the head-teacher. In this way the necessary work of preparing lessons out of school hours may be somewhat reduced.

Evening Schools.

44. Article 113 has been designed to encourage more advanced and varied teaching in the evening school, and at the same time to indicate clearly its character as a supplement to the day school rather than as a substitute for it. It may be hoped that ere long no scholar will leave the day school for labour who has not passed the full-time standard; but exceptional cases will arise in which a night scholar may not have reached this standard, or, having reached it, may have forgotten much of what he has learned, and may require to go back and recapitulate. For such cases the Code provides that examination may be as low as Standard III.; and there need be no objection, when a scholar has for some time been employed, to allowing him to repeat the examination for the last standard which he has previously passed. In all such cases satisfactory explanation should be furnished by the managers. If in any instance it is proposed to put a scholar back two standards, sufficient reasons should be assigned. The managers should take reasonable pains to procure evidence at each scholar's admission of the standard in which he has previously been presented, and of the standard for which he is fitted.

45. In framing the Code my lords have desired—while retaining as of prime importance the individual examination in reading, writing, and arithmetic—to give greater freedom of choice to good teachers in regard to other subjects, to attach increased weight to intelligence and to the quality of instruction, and to bring the mode of computing the grant into closer correspondence with the various conditions which determine the efficiency of the school. The full attainment of these objects depends largely on your personal exertions and influence, and on the spirit in which you co-operate with the best efforts of voluntary managers, School Boards, and other local bodies interested in promoting education. Their lordships are aware that some of the new duties which are imposed upon you by the Code of 1882 are delicate and onerous, and will call for the exercise, in a higher degree than ever, of carefulness, insight, and sympathy. But they rely with much confidence on the discretion, and ability of Her Majesty's inspectors, and on their willingness to give effect to any measure designed to improve the character of elementary schools, and to increase the public usefulness of the Education Department.

I have the honour to be, Sir,
Your obedient servant,
F. R. SANDFORD.

APPENDIX I.

EXAMINATION IN NEEDLEWORK (Schedule III.).

1. At least forty-five minutes should be given to this examination.

2. A table of exercises, to be worked in this time, is annexed. The material required for each is shown.

3. It is desirable that as a rule, and when the numbers in the standards to be examined are sufficiently large, the whole of the exercises should be given. You should therefore, as far as may be practicable, divide the scholars in each standard examined into as many groups (A, B, C, etc.) as there are exercises to be performed, and assign one exercise to the children of each group. Thus, for example, Standard IV. would be divided into five groups, and each of the five exercises would be worked in one of the groups.

4. Suitable needles, cotton, thimbles, and scissors, if not given out beforehand, should be in readiness for distribution with the other materials, so that time may not be lost at the examination. Each girl should fasten securely together the different specimens if the exercise include more than one.

5. If the specimens are taken away for examination, it is desirable that at the close of the time allotted each child's work should be folded separately, the exercises in each group tied together, and the whole made up in standards, and fastened up, with the name of the school outside.

6. Coloured cottons are recommended throughout. The object of giving two colours is to test the children's knowledge of 'joinings'; this must be attended to in all cases.

7. Great attention should be paid to evidence of carefulness in teaching 'joinings,' and 'fastenings' on and off, and to general neatness of finish.

8. In cutting out, more credit should be given to correct proportions, and useful intelligent work, than to elaborate or trimmed paper models. This applies more particularly to the cutting out that may be shown as part of the work of the year.

9. It is of great importance that teachers of all grades should give evidence of their power of teaching needlework by demonstration and by simultaneous method. You should therefore, whenever practicable, call upon one or more of the pupil-teachers and assistant-teachers in each school, and especially the certificated assistants, to give an oral lesson in your presence.

10. In infants' classes the children, including those who are too young to work exercises, should be prepared to go through the movements of needle position and knitting pin drill in your presence.

APPENDIX II.

REGISTRATION.

1. The Code requires that before any grant is made to a school the Education Department must be satisfied that suitable registers are provided, accurately kept, and periodically verified by the managers (Articles 8 and 95*c*), and again under Article 115 the grant may be reduced upon the inspector's report for faults of registration.

2. In every school there should be (1) a register of admission, progress, and withdrawal; (2) registers of daily attendance for all scholars; (3) a book of summaries. These registers must (Article 8) be provided by the managers out of the funds of the school, so as to be the property of the school, and not in any sense of the teacher.

Admission Register.

3. The *Admission Register* should be kept exclusively by the head-teacher, and made up at least once a week. Successive numbers should be allotted to the children on their admission, so that each child may have its own number, which it should retain throughout its school career. A child who returns to school after an absence of any duration would resume its original admission number. The name need not be re-entered in the Admission Book if the child is re-admitted in the course of one school year.

4. No child's name should be removed from the register on account of absence for any period less than six weeks (except in case of death), unless the managers have ascertained, or the school attendance officer reports, that the child has left the school or neighbourhood.

5. This register should show distinctly for each child in the school (*a*) its number on the register; (*b*) the date of its admission or re-admission, day, month, and year; (*c*) name in *full*, christian and surname; (*d*) the name and address of its parent or guardian; (*e*) whether exemption from religious instruction is claimed; *(*f*) the exact date of the child's birth, day, month, and year; *(*g*) the last school (if any) which it attended before entering this school; *(*h*) the highest standard in which it was there presented; (*i*) the successive standards in which presented in *this* school; (*k*) the date of leaving.

6. Where several children of the same name attend, they may be distinguished thus:—"John Jones (*a*)," "John Jones (*b*)," etc.

7. This register should have an alphabetical index.

Attendance Register.

8. *The attendance registers* must *be marked every time that the school meets*, however small the number of children present, and all attendances so marked must be taken into account. They should show the daily and weekly attendances of every scholar, beginning with the first day of the school year (Article 22), and continuing to the end of the same.

9. Adequate time for marking these registers should be provided for in the time-tables—from five to ten minutes or more—according to the number of scholars.

10. In mixed schools the boys should be entered in the upper part of a page, the girls in the lower, leaving a space between them.

11. On the outside of the cover of each register should be legibly written the name of the school and the year, also the department (boys', girls', mixed, or infants', as the case may be), and the class or classes to which it belongs. All registers should be paged.

12. There should be columns for each child's admission number, for its name in full, and its age last birthday, and columns for all the weeks in the year, which should always be dated at their head with the day and the month. One also for the morning attendances and another for the afternoon attendances of every day, with a place at their foot for adding them up. A column for school pence received in each week is not unfrequently added to the attendance columns; but as this is apt to cause confusion in the additions, both of the pence and of the attendances, the pence columns had better be kept separate, unless entries be made in them in red ink. There should be a column for the entry, at the close of each week, of the total attendances made by each child during that week, and at the end of the register columns, to sum up the total attendances of each child during the year. The Code requires a separate register for half-timers. The register for each class may be marked by the pupil-teacher (if he have completed his second year) having charge of the class; but the head-teacher will be held responsible for its being regularly and properly kept.

13. In marking the attendance registers the following rules should be observed:—(1) The registers must be marked, and, excepting marks cancelled under 10 *infrà*, be finally closed at least two hours before the termination of the time given to the secular instruction at each meeting of the school, and at the time specified on the approved time-table; (2) after the registers are closed no child may be marked; (3) children must be marked at each meeting of the school; (4) in ink, never in pencil inked over afterwards; (5) presence must be marked with a long stroke, thus, /, or \; (6) absence must be marked with an 'a'; (7) there must be no dots; (8) no erasures—if any error has been made it must be corrected by a footnote; (9) no blanks; (10) if a child leaves before the two hours of secular instruction expire, its mark for presence should be cancelled by another stroke across it, thus ×, and the total attendances for that meeting corrected by placing under them —1, —2, as the case may be; (11) registers must be original, and not copied from slates, papers, etc., on pretence of keeping them clean, or any other plea; (12) the number of attendances made by the class should be entered at the foot of the column every morning and afternoon at the time of closing the registers; (13) the number of attendances made by each child during the week must be entered; (14) when a half or whole holiday occurs, or on the occasion of days set apart for special inspection, under section 76 of the Education Act (when the meetings and attendances are *not* to be registered for the purpose of annual grants), a line should be drawn down the whole length of the column or columns; (15) for longer periods 'holiday' should be written across the columns.

14. At the foot of the attendance columns for each week, or in some place specially provided for them in the registers, should be entered: (*a*) the number of times the school was open, morning and afternoon; (*b*) the total number of attendances made by all the children on this register during the week.

15. At the foot of each pence column the total amount of pence received during the week.

Summary.

16. The *Summary* should contain (1) the weekly entries of the attendance of each class transferred from the class registers every week into appropriate pages, and the average attendance for each week; (2) at the completion of the year the annual averages for the whole school should be struck and entered of boys and girls separately—(1) under 3, (2) between 3 and 7, (3) above 7, and (4) above 8, and the highest weekly average noted; (5) the summary should be clear, and should at once show the results asked for in the Managers' Return (Form IX.)

17. In this book the duplicate examination schedules, and copies of the returns in Form IX., should be preserved, together with a list of scholars qualified to be presented, but not presented, with the reasons for their not being presented, and likewise of scholars presented a second time in the same standard, with the reasons for their being so presented.

18. The Managers' Return (Form IX.) will contain a certificate that the registers have been checked at irregular intervals, and at least once in every quarter, by the managers. To check the registers, the managers, or some one deputed by them, should visit the school, without previous notice, after the registers ought to be closed, and ascertain that the number of attendances marked tallies exactly with the number of children then present. An entry should also be made in the log-book and in the registers at the time of checking them; they should also be signed at the same time by the teachers responsible for them.

19. *The managers' return should show, by separate entries, the number of admissions and re-admissions in the course of the first and second halves of the school year respectively.*

20. *Attendance* registers, when filled, should be put away and preserved for at least *ten* years. Admission registers and summaries should never be destroyed.

21. The above rules are intended for day schools, but should be applied as far as possible to evening schools.

22. My lords do not at present insist upon uniform registers as a condition of annual grants, but they trust that by the co-operation of the managers of schools such an extent of uniformity may be gradually introduced as to make the adoption hereafter of a uniform system of registers a matter of little difficulty.

* Special care must be taken to obtain exact information on these points from the parents, former teachers, and registrar of births, if necessary.

In the following Table the requirements of the Code for each Standard are divided into groups of moderate length, any one of which may be given by the Inspector in their respective Standards.

Lower Division of Infants.	Upper Division of Infants.	Standard I.	Standard II.	Standard III.	Standard IV.	Standard V.	Standards VI. and VII.
A.—To hem 5 ins. in one colour. B.—To knit 6 rows of 12 loops previously cast on.	A.—To hem 5 inches in two colours so as to show a join. B.—To cast on 12 loops and knit 12 rows. **O.—To fix and work a hem of 5 inches in one colour.*	A.—To fix and work in two colours a length of 7 inches, and fix and work the two corners. B.—To cast on 20 loops, knit 20 rows with chain edge, and cast off. C.—To fix and work a sew and fell seam of 7 inches. **O.—To fix and work a seam of 7 inches and then fix 4 pleats in the joined material.*	A.—To fix and seam together two pieces in two colours and hem round the four sides. B.—To cast on 20 loops and knit 20 rows, ribbed, pearl, and plain, breaking and joining the wool at least once in the space; afterwards cast off. C.—To fix and work in two colours a sew and fell seam of 7 inches, using two colours in both seam and fell. **O.—To pleat 7 inches into at least 6 pleats, and hem it into a band of 3 inches.*	A.—To prepare for stitching, and stitch at least half of a piece 7 inches long in two colours, and to sew on a string. B.—To cast on 40 loops and knit with 4 pins 15 rows, breaking and joining the wool at least once in the space; afterwards cast off. C.—To herring-bone down the four sides of a piece of flannel about 4 inches square. D.—To darn 10 rows 1½ inch long on cheese cloth or calico, and mark on the same material two letters out of the first six of the alphabet. These letters may be the same for the whole of the group.	A.—To gather and stroke down 7 inches, and set into a band of 3 inches. B.—To put in a flannel patch about 2 inches square, and darn 10 rows 1 inch long on the same material. C.—To cast on 31 loops and make the heel of a stocking, turn it, and cast off. D.—To double down and tack a piece of calico, and on this cut and work two buttonholes—one with both ends round, the other with both braced—and sew on a linen button. E.—To mark on calico two letters chosen by the inspector, and to darn an irregular space about 1 (square) inch on stocking web material.	A.—To turn down and tack a hem ¾ inch wide, and on this cut and work a buttonhole with one end round and the other braced, run two tucks 7 inches long, and sew on a linen button. B.—To put in a calico patch about 2 inches square, and mark on the patch one of own initials. C.—To cast on 20 loops, and knit with 2 pins 40 rows showing seam stitch and three decreasings on each side as for the back of a stocking. D.—To cut out and tack together pattern of pinafore, to plain darn a hole ½ inch square on stocking web material. E.—To sew and fell 2 inches of pieces 7 inches long and put in gusset as for body of shirt and stitch it across.	A.—To cut out and tack together pattern of girl's shift, also to graft 3 inches and to take up a ladder. B.—To darn calico on a diagonal cut ½ inch long. C.—To darn an irregular space of about 2 square inches on some dress material, and to put in a patch about 2 inches square on same material. D.—To cast on 40 loops, knit 5 rows with 4 pins, divide and knit a thickened heel, turn it, and pick up the gusset and cast off. E.—To hem and whip 6 inches of frill and set on to calico band, and mark on the band one of own initials. **O.—To Swiss darn a space 1 inch square, and on a calico hem ¾ inch wide, do 2 inches of knotting, and 2 inches of coral stitch.*

MATERIALS REQUIRED FOR THE EXERCISES IN EACH OF THE ABOVE GROUPS.

N.B.—It is desirable to use 'Betweens' for sewing needles, short pins for knitting, and fine cotton generally throughout the Standards.

A.—A piece of calico 5 inches by 2, fixed for hemming, and coloured cotton. B.—A pair of knitting pins, with 12 loops cast on, and cotton.	A.—A piece of calico, 5 inches by 2, fixed for hemming, and cotton of two colours. B.—A pair of knitting pins and cotton or wool. †*O.—A piece of calico 5 inches by 2, and coloured cotton.*	A.—A piece of calico 7 inches by 3½, and cotton of two colours. B.—A pair of knitting pins and cotton or wool. C.—Two pieces of calico 7 inches by 3½, and coloured cotton. *O.—Two pieces of calico 7 inches by 3½, and coloured cotton.*	A.—A piece of calico 7 inches by 3½, and cotton of two colours. B.—A pair of knitting pins and wool. C.—Two pieces of calico 7 inches by 3½, and coloured cotton of two colours. *O.—A piece of calico 7 inches square, and a piece 3½ inches square.*	A.—A piece of calico 7 inches by 3½, about 2 inches of tape, and cotton of two colours. B.—A set of knitting pins and wool. C.—A piece of flannel 4½ inches square. D.—A piece of cheese cloth or calico 4½ inches square.	A.—A piece of calico 7 inches square, and a piece 3½ inches square. B.—A piece of flannel 4½ ins. square, and a piece 2½ ins. square. C.—A pair of knitting pins and wool. D.—A piece of calico 3½ inches square, and a linen button not pierced. E.—A piece of calico 3½ inches square, and a piece of stocking web 3 inches by 4.	A.—A piece of calico 7 inches square, and a linen button not pierced. B.—A piece of calico 7 inches square, and a piece 3½ inches square. C.—A set of knitting pins and wool. D.—A sheet of tissue or lined paper about a yard square. A piece of stocking web 3 inches by 4. E.—Two pieces of calico 7 inches by 3½, and a piece 3½ inches square.	A.—A sheet of tissue or lined paper about a yard and a quarter by a yard wide. Also two pieces of stocking web, 3 inches by 4, one of them with a ladder an inch long. B.—A piece of calico 3½ inches square. C.—A piece of dress material 7 inches square and a piece 3½ inches square. D.—A set of knitting pins and wool. E.—A piece of mull muslin 6 inches by 1, and a piece of calico 3½ inches square. *O.—A piece of stocking web 3 inches by 2, and a piece of calico 7 inches by 3½.*

* Exercise *O* is optional. † The material required for each group should be carefully prepared and arranged beforehand, so that time may not be lost at the examination. The quantity provided should be in excess of what is likely to be used.

*** Art. 109 (f.) has been amended by the omission in (i.) 5, of the words, '*in mixed schools*'; so that Needlework may now be taken as a second 'class' subject by Girls in any School.

Syllabus of Exercises for Pupil-Teachers on the day of Annual Examination.

FIRST YEAR.	SECOND YEAR.	THIRD YEAR.	FOURTH YEAR.
FIRST EXERCISE. Join two pieces of calico together by seam and fell. Gather, stroke, and set in one joined end into a band. Hem the bottom, sew on a tape-string. **SECOND EXERCISE.** Cast on 39 loops, and with two pins knit a piece as if for the calf of a stocking showing three decreasings, and cast off.	**FIRST EXERCISE.** Make a band with calico, on it work a button-hole, set on a button, and hem, whip, and set on a frill. **SECOND EXERCISE** Fold down a hem on calico, on it work a button-hole with different ends, and run at least two tucks, and mark one letter chosen by the inspector. **THIRD EXERCISE.** Cast on 40 loops, knit and purl 4 and 4 for 4 rows, then alternate the squares to form a chequer three times, and cast off.	**FIRST EXERCISE.** Put in a patch in print about 3 inches square. Draw a letter, chosen by the inspector, in pencil on the patch, and work it out in stitching. **SECOND EXERCISE.** Set in a triangular patch in flannel about 3 inches each way; on it darn 10 rows as for a thin place. **THIRD EXERCISE.** Cast on 51 loops, knit a thickened heel, turn it 'Dutch' shape, and cast off.	**FIRST EXERCISE.** Join two pieces of calico half their length, and insert a gusset, as for the body of a shirt, and stitch it across. Also work at least two inches of coral stitch, and mark one figure chosen by the inspector. **SECOND EXERCISE.** On a stitched band work a button-hole as for the left side of a shirt-front, and another as for the back of an infant's robe. Sew on a tape string and a button. **THIRD EXERCISE.** Set in a calico patch about 3 inches square, and mark one letter and one figure chosen by the inspector. **FOURTH EXERCISE.** Cast on 40 loops, and with 4 pins make the toe of a sock.

MATERIALS REQUIRED FOR THE ABOVE EXERCISES.

FIRST EXERCISE 1 piece of calico 3½ by 3½ inches. 2 pieces of calico 7 by 3½ inches. 1 piece of tape 2½ inches long. 6 yards sewing cotton. 2 sewing needles. **SECOND EXERCISE.** 2 knitting pins. 10 rounds of a skein of wool or cotton.	**FIRST EXERCISE.** 1 piece of calico, 7 by 3½ inches. 1 piece of mull, 1 by 6 inches. 1 linen unpierced button. 6 yards sewing cotton. 2 sewing needles. **SECOND EXERCISE.** 1 piece of calico 7 by 7 inches. 2 sewing needles. 6 yards sewing cotton. 1 yard marking cotton. **THIRD EXERCISE.** 4 knitting pins. 10 rounds of a skein of wool or cotton.	**FIRST EXERCISE.** 1 piece of print, 9 by 9 inches. 6 yards of sewing cotton 2 sewing needles. **SECOND EXERCISE.** 1 piece of flannel, 9 by 9 inches. 2 sewing needles. 6 yards sewing cotton. 2 yards darning cotton. 1 darning needle. 1 yard marking or common coloured cotton. **THIRD EXERCISE.** 2 knitting pins. 10 rounds of a skein of wool or cotton.	**FIRST EXERCISE.** 1 piece of calico, 3½ by 3½ inches. 2 pieces of calico, 7 by 3½ inches. 6 yards sewing cotton. 2 sewing needles. 1 yard marking cotton. **SECOND EXERCISE.** 1 piece of calico, 7 by 3½ inches. 1 linen unpierced button. 1 piece of tape 2½ inches long. 2 sewing needles. 6 yards sewing cotton. **THIRD EXERCISE.** 1 piece of calico, 7 by 7 inches. 1 piece of calico, 3½ by 3½ inches. 2 sewing needles. 6 yards sewing cotton. 1 yard marking cotton. **FOURTH EXERCISE.** 4 knitting pins. 20 rounds of a skein of wool or cotton

N.B.—It is optional to the inspector to choose which of the above exercises shall be done in his presence.
Fine needles (Betweens), with fine cotton, No. 16 knitting pins, and No. 10 knitting cotton or 'fingering' yarn are recommended throughout.
The sizes of the pieces are given to show the amount necessary. Larger pieces can be used if desired.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose name and address we will gladly give.

History of Shorthand. By Thomas Anderson. London: W. H. Allen and Co., Waterloo Place.

In reading some passages in this book it would appear to be impossible for the utterances of a tolerably rapid speaker to be taken down with anything like verbal accuracy, and that confusion must occur in 'words nearly alike in sound,' as the old spelling books have it. Further, that Odell's recommendation to 'dash with the pen, take down the very words,' which we read in the little book he published some half-century ago, was a sheer impossibility. How far a clever reporter trusts to his memory when his hand 'forgets its cunning' is, we fancy, yet open to dispute. But notwithstanding the apparent intricacy of the art and the apparent difficulties in the way of decyphering the symbols, the fact remains that by aid of these dots, dashes, and curves—we hope we may be permitted to say 'by hook or by crook'—speeches are taken down with an astonishing approach to accuracy. We had the pleasure of listening to a sermon in company with the veteran stenographer, Mr. F. Pitman, and of hearing this gentleman read, for our edification, an extract from the said sermon, and which astonished us by the marvellous accuracy with which—to the best of our recollection—every word was reproduced! We mention this to account in some way for the popularity of Pitman's system, which Mr. Anderson is disposed to criticise if not condemn as being connected with the Quixotic attempt to revolutionize in the desire of reforming our orthography. Of course, the judgment of professors, or, at least, experts in reporting, is requisite to decide upon the comparative merits of different systems, and even then each system is naturally enough defended by those who acquire dexterity therein. But amid all this contention—for this by-path of literature seems to be trodden by vivacious disputants—the student as well as the general reader will find the whole history of the art detailed in Mr. Anderson's pages, with interesting information of the early attempts of the Greeks and Romans in the same field. Short notices of the state of the art among the principal European nations, and also among the Americans, are also given. Mr. Anderson regards Gurney's abbreviations as certain, though numerous and lacking comprehensiveness, while Gabelsberger's are comprehensive though somewhat uncertain. Pitman's he regards as numerous, arbitrary, and not always sure. Further, he regards

Gurney's as the best representative of legibility, Gabelsberger's of ease, and Taylor's of rapidity. Pitman's he regards briefer than all others, but thinks this brevity compassed at too great a cost in the way of accuracy. Doubtless in this art progress is altogether disconnected with such happy discoveries as reward the scientific experimenter. Though the stenographer or phonographer has to work his way by laborious effort, yet the improvements in the past justify hope of more success in the future.

Mensuration for Beginners. Part I. Mensuration of Plane Surfaces. By William Dodds. London: Murby.

This book would have been more appropriately named 'The Beginning of Mensuration,' as it comprises squares, rectilinear figures, and plane triangles only, and stops short of circles. So far as it goes, however, the book is useful, and the examples varied and well chosen. Most of the rules are accompanied by a geometrical demonstration excepting the finding of the area of a triangle from the data of three given sides. This is not easily demonstrated it is true, except by trigonometrical formulæ, but may be accompanied with an algebraical elucidation, such, for instance, as that given by old Bonnycastle. The arcana of links, chains, and acres, grievously puzzling to beginners, are here fairly explained.

Readings in English History. For the Upper Classes in Schools. London: Thomas Murby.

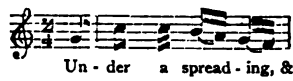
This compilation is formed of extracts from several popular historians, including Macaulay, Hume, Carlyle, Bancroft, Greene, Motley, together with sketches from Dickens, Hepworth Dixon, Howitt, and Gairdner in the way of prose, and several poetical extracts from Shakspere, Scott, Wordsworth, and Southey. To several of the chapters explanatory notes are appended, which will greatly facilitate the appreciation and understanding of difficult words and allusions among youthful readers.

Locke on Words. (*Locke's Book III. on the Essay Concerning the Human Understanding.*) By F. Ryland, M.A. London: Swan Sonnenschein.

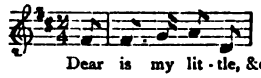
It needs no commendatory remarks to acquaint all well-informed readers of Locke's merits, nor of the clearness with which his truths are conveyed. Among the parts of his invaluable treatise this (Book III.) on *Words* is of especial value to those engaged in teaching. The edition before us is supplemented by a series of valuable notes by Mr. Ryland, of great use to the student, and most interesting to the general reader. The severe blows dealt to the schoolmen in the seventeenth century by Bruno, Bacon, Descartes, Gassendi, and Hobbes, evidently influenced Locke to express disapprobation for mere catchwords—in which the schoolmen often indulged—without perhaps recognising the acuteness and clearness with which the disciples of Aristotle carried on their wordy warfare. So far as intellectual culture was concerned the scholastics were useful, but by yielding to the influence of terms, which Locke condemns, they were drawn from the patient investigation of phenomena which is content with nothing short of demonstration. The schoolmen have been erroneously accused of neglecting observation; but the truth is that their observation was so mixed with mere verbalisms as to be in many cases unreliable and delusive. The old phrases of *Nature abhors a vacuum*, and the *spontaneous mobility of atoms* (*ab intrinseco propulsio*) are brought forward by Mr. Ryland with references to the best modern authorities thereon. Altogether the book is a praiseworthy and scholarly attempt to popularize, and, where needful, explain this 'immortal Third Book' of Locke's Essay.

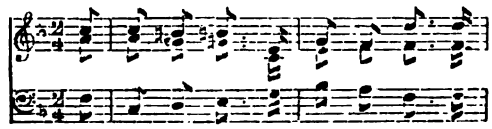
The Day-School Song-Book. By A. Johnson. London: Bemrose and Sons.

These songs are too full of defects both in music and poetry to become popular. The music in very many cases violates propriety of accent, as in Longfellow's 'Village Blacksmith' we have—



Mr. Rogers' beautiful lines are similarly murdered by wrong accent, thus:—



In other respects the music is varied from the baldest simplicity of an eight-bar tune, 'Pretty Pussy,' to the 'Song of the Smiths,' of nearly fifty bars, which opens thus, and with the chord of $\frac{6}{4}$—objectionable from being unresolved—at the end of the second bar:—

In regard to the words, we are told that the whale

'Measures seventy feet in length;
His tail is four-and-twenty broad;
And when he strikes, with its great strength
He scatters boats and crews abroad.'

After this bit of figurative writing we are introduced to the loving nature of the whale:—

'With deep affection he is blest,
This creature of such wondrous size:
He clasps his offspring to his breast
When wounded, and, to shield it, dies.'

After this gush of paternal affection we are told that—

'When dead, and he no longer feels
The pain, his teeth for bone they take,
And tons of oil his blubber yields
To oil machines and candles make.'

So that boys and girls are reconciled to the capture of the whale notwithstanding the gushing affection of the huge animal on account of the blubber and oil for machines and candles. Boys will simply laugh at such stuff as this!

The writer of the words—we dare not call it poetry—seems fond of *figurative* details: for example, he tells us about the hippopotamus that—

'His bulk, from tail to snout,
Is seventeen feet along:
His jaws he opens two feet wide;
His teeth are one foot long.'

We have not time to notice many grammatical defects, such as the omission of 3rds in the harmony that mark several passages of the music.

English Grammar. Parts I. to VI. for Standards II. to VII. By Thomas Morrison. London and Edinburgh: Gall and Inglis.

The gradation of lessons enforced by the code will bear good fruit in securing a wise avoidance of the more difficult branches of various subjects for the early standards and the concentration of the attention of pupils of the advanced standards on the higher matters of each subject. Hitherto teachers have not known how far to go, and have in many cases unwisely attempted too much. The very term grammar is so comprehensive as to be practically vague, unless circumscribed and graded for each code.

The numbers forming the series before us are generally well arranged according to the code requirements, and with some few exceptions accurately written. One of these exceptions is in the treatment of the subjunctive mood in Standard II. Mr. Morrison tells us (p. 32, part i.) that 'A verb is said to be in the subjunctive mood when it implies doubt or a supposition.' This is preceded by the example, '*If John strikes the table*, I don't state a fact, but make a supposition.' And, further, this is again defined in the summary (p. 48) thus:—'A verb is in the subjunctive mood when it implies doubt or uncertainty.' Not so. To *doubt* must be added *futurity* or the verb is not truly in the subjunctive. The auxiliary *should* will help us to determine the subjunctive, and we say 'If John should strike the table' in full, or without the guiding *should* 'If John strike the table,' but the element of futurity must be borne in mind as well as that of doubt to ensure the true form of the subjunctive; we may be in doubt about the weather, and say, 'If it rains, go out,' and herein we depart not from the indicative, notwithstanding the use of the 'if.' But when we say, 'Should it rain' or 'If it rain,' we refer to future time as well as uncertainty, and thus use the subjunctive. The sentence, 'If he comes, he will present the prizes,' given as an example of the subjunctive is ungrammatical, and should be, 'If he come, he will present the prizes.'

We believe it is the fashion to quarrel with the old definition of *the* being a definite article, and terming it instead a distinguishing adjective, in common with *this* and *that*. But the new definition fails in using *the*, as *this* and *that* are used without nouns. We say, 'Give me *this*,' and 'I can see *that*,' but we cannot say, 'I see *the*'; hence and for other reasons we prefer the old definition. We have also yet to learn that *laid* is the plural of *lay*, in the example given (p. 47, part iii.) to show the use of plural verbs to two singular nouns connected by *and*—'The snow lay deep upon the ground,' and 'The wind and the sun laid a wager.' It seems us that Mr. Morrison here confuses singular and plural with past and present. In Part VI., the author tells us that he 'gave a complete list of Saxon prefixes and affixes,' in Part IV. On turning to Part IV. we find these so-called Saxon words under the much more welcome and appropriate heading, English instead of Saxon. We have really had enough of Saxon, Anglo-Saxon, and the rest of it, and infinitely prefer Old English, if need be, to designate the speech of pre-Norman times.

Matriculation Classics. Questions and Answers. By Rev. J. R. Walters, B.A. London: H. K. Lewis.

This opusculum has reached a second edition, and thus we are led to the belief that it must supply a want. Nevertheless, it is of that class of books that are not the most desirable products of this examinational age. The points raised and explained are necessarily in no logical or even grammatical sequence, though an attempt is made to give the semblance of the latter by grouping the questions and answers under such heads as nouns, definitions, principal parts. Despite the ingenuity of the compiler, the impression left is as that of the dictionary-reader. It is very interesting, but the subjects are so disconnected. The good teacher certainly ought neither to allow himself or his pupil to read these books. Their chief use is for the brave, struggling students who are 'teaching themselves.' The answers are correct, though their manner would be a dangerous one for a young scholar to take as a model. They are at once too short and too long. Too short as to length, too long as to individual words. An examinee must never assume that an examiner knows that he knows. Explanations that he would never give to his teacher, inasmuch as the latter is aware that they are within the knowledge of the student, should be given to an examiner. And in the answer to question 4, page 2, we have the words 'syntactical,' 'simultaneous,' 'antecedent' in two lines. Nor is it wise for a matriculation student to enter into details as to the different usages of various writers, or as to doubtful points. Of course, it could not be expected that every question should be answered in detail, but one or two might have been treated thus as models for the student. One-fifth of the book is devoted to Greek questions, and the rest to Latin ones. The best part, on the whole, is the translation of certain English sentences into Latin.

London University Matriculation Papers, with Translations, Answers, and Solutions. June, 1882. By Stephen Barlet. London: Percy Young.

Much that we have written in regard to the book of the Rev. J. Walters might be repeated here. It is a strange result of the fervour for examinations that a publisher can find it worth while to issue a volume of 120 pages containing answers to the papers set at a single examination. We are not sure, again, that the result is a consummation devoutly to be wished. If we grant, however, that it is desirable that young people should be drilled even in the mechanism of question-answering, this volume will serve sufficiently well. The work is well done. In the mathematical and physical papers, a more frequent reference to principles, at the expense of some use of formulæ, might have been preferable. SO^2 is better regarded as the symbol of sulphur dioxide than as that of sulphurous acid. The book is not free from printer's errors, though it is notably free from graver blunders.

A Wall Map of Ireland. With an accompanying Handbook. Edinburgh and London: W. and A. K. Johnston.

We have as much pleasure in expressing our gratification with this map of Ireland as of that of Wales we have already noticed. No pains has been omitted to ensure accuracy, while the boldness of the coast line, the prominence given to the most important names, and the completeness of the information render this fine map all that can be desired. The handbook is really a valuable textbook on the geography of Ireland, and is prefaced by judicious remarks on the plan of teaching. The compiler of this handbook includes the Irish among the large body of Scots who settled in Argyleshire in the beginning of the sixth century. We know not how the Irish will like to be thus disposed of, but we should like to have met with some remarks relative to the heterogeneous sources of the people of Ireland, which may be gleaned from such useful little brochures as Bonwick's, 'Who are the Irish?'

Elementary Botany, Theoretical and Practical. By Henry Edmunds, B.Sc. London: Longmans, Green, and Co.

This small volume is designed to cover the same ground as the elementary examination of the Science and Art Department covers in regards to Botany. The book is systematic and generally accurate. The author has a plan, and our chief regret is that he does not at the outset take his reader into his confidence and state the nature of the plan. We are not sure, further, that to commence with the study of the seed is not rather unphilosophical. If we are to work from the known to the unknown, the best commencement is on the more familiar flower. After an account of the seed and of the cell, a still less known factor in plants, the organs, are studied seriatim, and their structure and functions are dealt with consecutively. This method is clearly preferable to the customary plan of taking anatomy, as a whole, first, and then physiology *en bloc*. A plan for the description of a plant, taken apparently from Aveling's Botanical Tables, a series of questions, and a glossary in which Greek words are printed in English characters for the benefit of those who only know Greek by sight, completes the book, which is exceedingly well illustrated. Unfortunately it is

disfigured by several printer's errors, some of which are in the matter of stops. Examples of these will be found on pages 22, 52, 59, 71, 91, 96, 149. Yet more unfortunately the English is not always of the highest order. An unhappy instance occurs in the very first paragraph of the preface and another in the first line of page 7. 'There appears to be two colouring matters,' on page 8, is not pretty. Our ancient enemy 'different to' crops up more than once, and as to pronouns Mr. Edmunds is almost as vague as Clarendon. Pages 9, 24, 39, furnish evidence on this point. But the writer's chief foe is 'and which,' whilst 'which,' single-handed at times, overcomes him. He is, moreover, a slave to the subjunctive, and as result of his servitude gives us such a sentence as, 'If a vessel be closed below by a piece of bladder whilst a tube be tightly fastened in the neck.' We commend to Mr. Edmunds a sentence from Professor Adams' excellent work on the English language: 'The present tendency of the English language is to reject the distinction of the subjunctive mood.' We lay stress upon these inelegancies and inaccuracies in a book on botany because we are firmly convinced as to the necessity of physical science being taught in accurate, well-chosen English. The young student ought to be brought into contact with every phase of culture, and if he finds looseness of grammatical expression, he will begin to suspect a possible looseness of botanical thought.

Several blunders in the volume under consideration seem to point to the conclusion that the writer is not strong in his chemistry. Thus, the formula of cellulose is given wrongly on page 6, and three pages further on the mistake is corroborated by the statement that 'starch has the same chemical composition as cellulose.' Now the formula of starch is $C^6H^{10}O^5$ and that of cellulose is $(C^6H^{10}O^5)^3$. We may be told that to point out such distinctions as this in an elementary book is unwise. We answer that the best method is to teach the whole truth rather than a part of it. In the particular case in point, the student of botany may never study organic chemistry and may never find out the slight error. But whether he does find it out or not, we are convinced that the best plan is to teach the whole truth if possible, and not only a part of it. The teacher in saving himself the trouble of a little more explanation may give the pupil far more trouble in his after studies. A similar criticism applies to the phrase 'salts of lime,' that is substituted for the more exact 'salts of calcium,' and to 'copper solution' in place of copper sulphate.

Something of looseness of phraseology pervades also the the strictly botanical part of the work. In the preface the word description takes the place of anatomy. Nor is it wise to speak of the two kingdoms of organised beings merging the one into the other, unless the young student is shown where that merging takes place. The confusion as to the meanings of the words anatomy, morphology, and histology, that we had occasion to notice in Dr. Vine's Translation of Prantl, obtains here, and is indeed rendered worse confounded by the statement that anatomy treats of *internal* structure. The misleading word, 'albumen,' is still retained, and that the coniferæ have many cotyledons is stated twice. Measurements are given in inches rather than in millimetres, two root functions on page 34 grow to four on pages 38, 39. Carbon dioxide is said to be taken in at the *pores* of the leaf, the pappus of Compositæ is a calycine development, the older names adnate and innate for anthers are preferred to the far more intelligible ones dorsifixed and basifixed. Finally, the use of the word 'intended' as to structures encountered in our study of physical science is questionable. We are justified in stating what functions particular parts subserve, but scarcely in saying aught as to purpose or intention in respect to them.

The book is, despite these and other shortcomings, a good book. It is well abreast of modern scientific knowledge, and its author has read the Germans. He shows himself a practical teacher by such suggestions as the one as to the method of teaching the kinds of vernation given on page 67. His account of the two effects of plants on the air, the one a respiratory, the other a digestive effect, is very clear. The plan adopted in dealing with this subject and the general build of the whole book, have led us to speculate whether its author was ever a student at the botany class at the Birkbeck Institution.

Grammar of Elocution. By John Millard. London: Longmans.

The real secret of good speaking is deep feeling: no man can stir a crowd with his tongue who does not bring up his utterances from the well-spring of his heart. Artificial rules will avail very little even to the help of natural eloquence, and as to its creation are practically nothing worth: as the author truly says, 'None can be made rivals to Demosthenes, Cicero, or Garrick in twelve lessons'—no, nor in twelve thousand: as with the poet, so with the orator, 'ille nascitur, non fit. And in particular as to the 'removal of stammering,' an affliction mainly due to nervous irritability, perhaps consequent on ill-health; didactic information and lessons in utterance are feeble curatives compared with courage and faith and prayer, as some stammerers who have cured themselves know experimentally. The best and most attractive part of Professor Millard's book is the voluminous appendix of passages for elocutionary practice selected from our chief writers in prose and poetry.

Art Instruction in England. By F. E. Hulme, F.L.S. London: Longmans.

The author is justly enough caustic and critical against the false old system of ordinary drawing masters, who themselves did the most part of their pupils' exercises, and so cheated parents into admiration of their children's works, due mainly to the paints and pencil of the teacher. Freehand drawing is the best and most honest exercise for eye and head; and there can be no fraud here: let the pupil copy for himself what he sees, and whether he succeeds or fails in imitation, by all means let there be no touching up. 'Drawing,' to quote the excellent common-sense remarks of Redgrave, 'is a language, an intelligent mode of communicating thoughts, "known and read of all men."'

The whole extract is too long for our space; but the booklet is so small and so full of excellent matter, that it deserves to be bought and read in its entirety.

Old Stories from British History. By F. York Powell, M.A. London: Longmans and Co.

These 'Old Stories,' penned as they are by a masterhand, will charm both old and young. We are sorry, however, that we cannot recommend the book for use in the standard for which it has been prepared, namely, the first. It is far too difficult. The second sentence on the first page reads:—

'For some time after they came here they were heathens, like some of the black people you read about who live in foreign lands beyond the sea, and like them they worshipped many gods, and believed many strange stories about them.' And on the very next page the first sentence is:—

'There were good sailors and brave soldiers, hard-working farmers, and skilful smiths, and carpenters among them; and they could take care of themselves, and hold their own whether at work or play.'

These extracts, taken at random, fairly indicate the character of the book, which is certainly stiff enough for the third standard, never to mention the first. Indeed, if the paragraphs were shorter and a few more stories added, the book would make an excellent standard three historical reader adapted in all respects to the Mundella Code. The little book is printed in beautiful type, and is well and suitably illustrated.

Reep's Summary of English History. London: Longmans and Co.

This is an admirable 'Summary,' based on Mr. Gardiner's 'Outlines of English History,' and cannot fail to prove valuable to any candidate reading up for an examination.

Talks about Science. By the late Thomas Dunman; with a Biographical Sketch, by Charles Welsh. London: Griffith and Farran.

We had the pleasure of bearing our testimony of commendation to the 'Glossary of Biological, Anatomical, and Physiological Terms,' by the same author, whose death, we regret to learn, took place a month or two ago. The short biographical sketch furnished by Mr. Welsh is deeply interesting, and shows the influence of modern scientific teaching in awakening the intelligence and stimulating the efforts of the youth around us. Mr. Dunman had barely attained the age of thirty-two years at his death, and had marked his too brief life by great zeal and usefulness as a scientific lecturer and teacher, in addition to his engagement as professor of physiology at the Birkbeck Institution and lecturer at the Working Men's College in Great Ormond Street. The volume before us contains thirteen lectures on scientific subjects, and though of varied merit are all marked by accuracy and clearness. They are enlivened by occasional touches of humour, which we suppose is a necessary feature of the popular lecture. For a general introduction to the subjects on which they treat, they will well repay the attention of the student and general reader. They are marked by the carefulness of demonstration and absence of mere theorizing upon insufficient data that marked the old popular lecturers, and are also distinguished from the latter by a steadfast tone of instruction and the absence of the mere element of amusement which has played such havoc with the scientific designs of Dr. Birkbeck and the friends of the old Mechanics' Institutions. The example of Thomas Dunman shows that the scientific lessons of Huxley and his disciples are bearing good fruit. The increased attention now given to physiology—geology especially—and the careful manner in which these subjects are studied is very gratifying. Teachers may be greatly encouraged in the work of commencing an elementary acquaintance with science among their pupils by the certainty of their labours being successful in stimulating many to a life of thoughtful observation and inquiry. Let us take courage! The schoolmaster is abroad! and the seed he now sows falls neither among thorns nor in stony places.

Our Little Ones. London: Griffith and Farran.

The excellence of this magazine is maintained in the most recent numbers. As usual, the illustrations are superb.

Italy's Liberator: The Story of General Garibaldi's life. London: Partridge and Co.

'A pure, spotless, patriot-hero,'—such is the character of Giuseppe Garibaldi, as his life has shown and history records; this well-written little memoir amply proving his courageous and unselfish excellence. He was the son of an honest sailor, though a zealous Papist; which latter phase of mind reacted on Garibaldi in a thorough hatred of priestcraft; whilst his mother's fervent piety appears to have mainly influenced his strong feelings of natural—as opposed to ecclesiastical—religion. The incidents of Garibaldi's career are well known, and are detailed in this neat little volume simply and clearly; whilst its profusion of illustrations, both within and without, will serve as an additional recommendation to thousands of readers.

Latin Course (First Year), comprising Grammar to the End of the Regular Verbs and Exercises with Vocabularies. London: W. and R. Chambers.

An anonymous but worthy little book. Very much new matter or even new arrangement is hardly to be expected in a book of this sort, and perhaps the most striking novelty in it is the title-page. This is absolutely destitute of any punctuation marks whatever. The selection of grammatical fragments is, on the whole, well made, and the exercises, very wisely relegated to the end of the volume, far away from the ease-giving vocabulary and the attractive paradigm, are of sufficiently typical sentences, although twenty-one of them hardly seems a sufficient number for even a first-year student of Latin. A child might manage one a week, at least. We are inclined to think that definitions of such words as gender and number might be given with advantage. Such definitions are of value in a book like this for repetition and for reference sake. After each declension follows a careful selection of the chief difficulties in regard to the nouns of that declension, and on page 22 the pupil is wisely taught to decline adjective and noun simultaneously. The summing up on page 11 as to nouns in *es*, the amended and extended list of nouns whose significance varies in the singular and plural numbers, and the clearing up of the perennial difficulty of the youthful student as to the future subjunctive and future infinitive of deponent verbs, effected on page 60, are all points of merit. The book may be recommended to all who have not the ingenuity and the patience to effect for themselves the work done by this little volume.

Chambers's Historical Readers, Nos. 1 and 2. London: W. and R. Chambers.

The two volumes have evidently been prepared by a practised hand. They contain much sound information presented in a form that children can readily understand. Overworked teachers will thank us for drawing their attention to a valuable negative merit which they possess—a merit which ought to be fully appreciated in these days—viz., that of *not being too long*. These capital readers contain ample matter for the standards for which they are designed.

Blackie's Geographical Reader, No. 1 for Standard I.; **Blackie's Geographical Reader,** No. 2 for Standard II. London: Blackie and Son.

These two little books, which have been prepared to meet the now well-known requirements of Mr. Mundella's Code, are worthy of the highest praise. Practical, handy, printed in Messrs. Blackie's best style on good paper, enriched with excellent and appropriate illustrations, strongly bound, and last but not least, well within the grasp of the children for whom they are designed, these introductory Geographical Readers are sure to be largely used in our public elementary schools.

Pictures of English History for Standard V. London: Nelson and Sons.

It would be a hard task to please either inspector, teacher, or scholar who would not be satisfied, nay, even gratified, with these pleasant pictures. Each picture, written in an attractive style, is prefaced with a short but valuable summary of the reign from which it is taken. The book is admirably adapted for a reader, notes and vocabularies having wisely been retained at the end of each lesson. The illustrations and general get up of the volume are worthy of the famous house whose imprint it bears.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. W. B. W., Grimsby.—A merchant mixes wine at 16s. with equal quantities at 17s. and 20s. per gallon, so that it might be sold at 18s. What proportion at each price was mixed?

Loss on wine at 16s. = 2s. per gal.
,, ,, 17s. = 1s. ,,
Gain ,, 20s. = 2s. ,,

∴ Gain on equal quantities at 17s. and 20s. = 1s. per gal.
∴ Wine at 16s. : equal quantities of wine at 17s. and 20s.
:: 1 : 2.

That is, the wines must be mixed in the proportion of 1 gallon at 16s. to 2 gallons at 17s., and 2 gallons at 20s.

2. TARDUS, Newport.—If 56 horses eat 30 bushels of oats in 15 days, how many oxen will eat 50 bushels in 20 days, if the rates of eating of an ox and a horse are as 3 to 5?

bus. bus.
30 : 50 } horses
days days } :: 56
20 : 15 }

$$= \frac{5\cancel{0} \times \cancel{1}\cancel{5} \times \cancel{5}\cancel{6}}{\cancel{3}\cancel{0} \times \cancel{2}\cancel{0}} \text{ horses}$$

$$= 70 \text{ horses.}$$

5 horses eat as much as 3 oxen,
∴ 70 ,, ,, (3 × 14) oxen
= 42 oxen. Ans.

3. YELSERP.—What sum would be saved annually if the interest on a public debt of £4,000,000 were reduced from 3½ per cent. to 3 per cent.? If, in consequence, the price of this stock fell from £101 to £95¼, how much would the whole property of the fundholders be diminished? (*Barnard Smith.*)

Sum saved = ½ p. c. on £4,000,000
= ½ of £40,000
= £20,000. Ans.

Amount diminished = (101 − 95¼) p. c. on £4,000,000
= 5¼ of £40,000
= £200,000 + £25,000
= £225,000. Ans.

NOTE.—Writing pretty good.

4. DON TALVA, Arbroath.—Divide £1766 7s. 10d. among A, B, and C, so that 5 times A's share, 6 times B's, and 7 times C's may be equal.

$$\frac{1}{5} + \frac{1}{6} + \frac{1}{7} = \frac{42 + 35 + 30}{210} = \frac{107}{210};$$

£1,766 7s. 10d. ÷ 107 = £16 10s. 2d.
∴ A's share = £16 10s. 2d. × 42 = £693 7s.
B's ,, = ,, × 35 = £577 15s. 10d.
C's ,, = ,, × 30 = £495 5s. } Ans.

5. TIMBER.—At what time between 11 and 12 o'clock are the hour and minute hands of a watch—1st together, 2nd at right angles, and 3rd directly opposite?

The minute hand moves twelve times as fast as the hour hand;
∴ The difference between the rates of the minute and hour hands is eleven times the rate of the hour hand.

1st. The minute hand must gain 55 minutes on the hour hand to be together;
∴ Distance gone by hour hand = 55 min. ÷ 11 = 5 min.
∴ Time when the hands are together = 12 o'clock.

2nd. The minute hand must gain 10 and 40 minutes respectively on the hour hand to be at right angles;
∴ Distance gone by hour hand = 10 min. ÷ 11 and 40 min. ÷ 11
= 1 1/11 min. and 3 7/11 min.
∴ Time when the hands are at right angles = 10 1/11 min. and 43 7/11 min. past 11 o'clock.

3rd. The minute hand must gain 25 minutes on the hour hand to be directly opposite;
∴ Distance gone by hour hand = 25 min. ÷ 11 = 2 3/11 min.
∴ Time when the hands are directly opposite = 27 3/11 min. past 11 o'clock.

6. LANCASTER.—If 9 oxen are kept for the same money as 7 horses (for any given time), and a team of oxen are ½ as long again in ploughing 97 acres, as the same number of horses in ploughing 90 acres, and a field costs as much whether ploughed by oxen or horses, *viz.*, £7 5s. 6d.; the same men being required in both cases and being paid by the time, what is due to them? (*Colenso.*)

Cost of food for 9 cows = cost of food for 7 horses,
∴ Quantity of food eaten by cows = 7/9 of quantity of food eaten by same number of horses.

Number of acres ploughed by horses while same number of cows plough 97 acres = 90 × 3/2 = 108.
∴ With cows the men are paid 108/97 times as much as with horses;
∴ Excess of money for labour with cows = 108/97 − 1 = 11/97 of the cost of labour with horses.

Cost of food for cows = 7/9 of 108/97 = 84/97 of cost of food for horses;

$\therefore$ Excess of cost of food for horses $= 1 - \frac{8}{9} = \frac{1}{9}$ of cost of food for horses.

$\therefore$ $\frac{1}{9}$ of the cost for labour with horses $= \frac{1}{9}$ of cost of food for horses.

11 times cost of labour with horses = 13 times cost of food for horses;

$\therefore$ Cost of labour with horses $= \frac{13}{11+13}$ of £7 5s. 6d.

$= \frac{13}{24}$ of £7 5s. 6d.

$=$ £3 18s. 9$\frac{3}{4}$d.

Cost of labour with cows $= \frac{1}{9} \frac{0}{7} \frac{8}{7}$ of cost of labour with horses.

$= \frac{1}{9} \frac{0}{7} \frac{8}{7}$ of £3 18s. 9$\frac{3}{4}$d.

$=$ £4 7s. 9.

Mensuration.

1. A STREET ARAB.—Two similar logs of wood, each measuring 18 ft. in length and 8$\frac{1}{2}$ inches sq. sectional area, were sent to be sawn up, each into 11 boards of equal thickness, to floor a room. A saw which destroyed $\frac{1}{8}$ inch of the board in making its cut was used, and in consequence there was inefficient flooring material. Had similar boards been cut with a saw which destroyed $\frac{1}{11}$ as much, there would have been a surplus of 22$\frac{1}{2}$ sq. ft. What was the area of the room?

Breadth of boards in second case $= (8\frac{1}{2} - \frac{8}{11}$ of $\frac{1}{8})$ in.

$= (8\frac{1}{2} - \frac{1}{11})$ in.

$= 8\frac{9}{11}$ in.

Area of each board $= 8\frac{9}{11}$ in. $\times$ 18 ft.

,, boards $= \left(\frac{743}{88} \times \frac{\overset{3}{\cancel{18}}}{\cancel{11}} \times \frac{\cancel{11}}{\underset{1}{\cancel{1}}}\right)$ sq. ft.

$= \frac{\overset{4}{\cancel{2}}\overset{2}{\cancel{12}}}{\underset{1}{\cancel{8}}}$ sq. ft.

$= 278\frac{4}{8}$ sq. ft.

$\therefore$ Area of floor $= (278\frac{4}{8} - 22\frac{1}{2})$ sq. ft.

$= 256\frac{4}{8}$ sq. ft.

Note.—*Reid's* 'Dictionary of the English Language,' 6s. 6d. (Oliver and Boyd); *Webster's* 'Dictionary of the English Language,' 10s. 6d. (George Routledge and Sons).

General.

1. IGNORAMUS.—We think your best plan would be to write to the Religious Tract Society (Paternoster Row) or the Society for Promoting Christian Knowledge (Northumberland Avenue, Charing Cross), for lists of their publications.

2. IGNORANCE.—Writing fair, but apparently needs practice. Make a point of never writing anything in a slipshod careless way, and you will soon find a marked improvement.

3. PRECEPTOR.—We cannot name a cheap treatise on the subject you mention, except in the shape of magazine articles, one of which appeared in 'All the Year Round,' under the heading, *A Question of Ancestry*, another in 'St. Paul's Magazine,' entitled *Briton or Saxon*. In the way of a complete treatise we should recommend *Dr. Nicholas's* 'Pedigree of the English,' a thick 8vo. volume, to be had for 5s. or 6s.

4. H. R. L.—Text:—The *Rugby* edition is good (Rivingtons), and you might try *Hunter's* (Longmans), or the *Globe* (Macmillan), or the *Leopold* (Cassell's). Works on the plays:—*Lloyd's* 'Critical Essays' (Bell and Sons, 2s. 6d.); *Hazlitt's* 'Characters of Shakspere's Plays' (Bell and Sons, 2s.), and *Gervinus's* 'Commentaries' (Kegan Paul, Trench and Co., 14s.), would be useful. So far as we know there is no *special* work on the particular play you mention.

5. CYMRO GLAN.—'How to draw a Map' (Hughes, 1s.), will give you the desired information.

6. MATHEMATICUS.—You cannot well do better than expend 2s. on 'What to Read, and How to Read it,' a small handbook to the Matriculation Examination, published by Stewart and Co, Holborn Viaduct Steps.

7. ENTRE NOUS.—The letter *H* is silent on the following words: *heir*, and its derivatives *heirless*, *heirloom*, etc.; *herb* (sometimes); honour, and its derivatives *honorarium*, *honorary*, etc.; *honest*, *hospital* (sometimes); *hotel* (sometimes); *hostler* (sometimes); *hour*, *humble* (sometimes); humour, and its derivatives. There is no rule. Writing good, and will improve with practice.

8. AGRICOLA.—The following will probably be useful:—*Carey's* 'Principles of Agriculture,' 2s. (Thomas Murby); 'Handbook of Agriculture,' by *S. Tomlinson*, 6d. (Thomas Brear, Bradford, Yorkshire).

9. ASHCROFT.—You will find the solution of your query in the January No.

10. DERMOT.—Your query was solved in the January No.

11. D. T. Z.—The solution of your query appeared in our issue for February.

12. NORTHUMBERLAND. — *Magnus's* 'Mechanics' (Longmans, 3s. 6d.); *Irving's* 'Heat' (Longmans, 2s. 6d.); *Magnus's* 'Hydrostatics' (Macmillan, 1s. 6d.); *Haughton's* 'Optics' (Cassell); Deschanel, I., II., IV., each 4s. 6d. (Blackie).

13. JUNIOR.—Your analysis is correct, with the exception of placing '*if*' in the predicate in the first sentence.

14. C. E. R., Wigan.—There is no legal remedy for you. You had better represent the case to the Head Master in a proper spirit, who ought to see fully to your interests.

Algebra.

1. J. BARAGWANATH.—Find the G. C. M. of

$x^3 + ax^2 - axy - y^3$ and $x^4 + 2x^3y - a^2x^2 + x^2y^2 - 2axy^2 - y^4$. (*Todhunter.*)

$x^3 + ax^2 - axy - y^3 \overline{)x^4 + 2x^3y + x^2(y^2 - a^2) - 2axy^2 - y^4}\ (x + 2y - a$

$x^4 + ax^3 - ax^2y - xy^2$

$(2y - a)x^3 + x^2(y^2 + ay - a^2) + x(y^3 - a^2y) - y^4$

$(2y - a)x^3 + x^2(2ay - a^2) + x(-2ay^2 + a^2y) - y^3(2y - a)$

Dividing by $y^2 - ay$ $\overline{)x^2(y^2 - ay) + x(y^3 - a^2y) + y^4 - ay^3}\ (x + y$

$x^2 + x(y + a) + y^2$

$x^2 + x(y + a) + y^2 \overline{)x^3 + ax^2 - axy - y^3}\ (x - y$

$x^3 + ax^2 + xy^2$

$- x^2y - xy(a + y) - y^3$

$- x^2y - xy(a + y) - y^3$

$\therefore$ G. C. M. $= x^2 + (a + y)x + y^2$

2. CONO.—Simplify:—

(*a*) $2\sqrt[3]{54} + 3\sqrt[3]{32} - 7\sqrt[3]{128} - 5\sqrt[3]{2} + 9\sqrt[3]{256}$.

(*b*) $\frac{7\sqrt{2} + 3\sqrt{14}}{29 - 2\sqrt{7}}$

(*a*) $2\sqrt[3]{54} + 3\sqrt[3]{32} - 7\sqrt[3]{128} - 5\sqrt[3]{2} + 9\sqrt[3]{250}$

$= 2\sqrt[3]{27 \times 2} + 3\sqrt[3]{8 \times 4} - 7\sqrt{64 \times 2} - 5\sqrt[3]{2} + 9\sqrt[3]{64 \times 4}$

$= 2 \times 3\sqrt[3]{2} + 3 \times 2\sqrt[3]{4} - 7 \times 4\sqrt[3]{2} - 5\sqrt[3]{2} + 9 \times 4\sqrt[3]{4}$

$= 6\sqrt[3]{2} + 6\sqrt[3]{4} - 28\sqrt[3]{2} - 5\sqrt[3]{2} + 36\sqrt[3]{4}$

$= 42\sqrt[3]{4} - 27\sqrt[3]{2}$

$= 3\sqrt[3]{2}(14\sqrt[3]{2} - 9)$. Ans.

(*b*) $\frac{7\sqrt{2} + 3\sqrt{14}}{29 - 2\sqrt{7}}$

$= \frac{(7\sqrt{2} + 3\sqrt{14})(29 + 2\sqrt{7})}{(29 - 2\sqrt{7})(29 + 2\sqrt{7})}$

$= \frac{245\sqrt{2} + 101\sqrt{14}}{841 - 28}$

$= \frac{\sqrt{2}(245 + 101\sqrt{7})}{813}$. Ans.

3. YRREB.—A train left Cambridge for London with a certain number of passengers, 40 more second-class than first-class; and 7 of the former would pay together 2s. less than 4 of the latter. The fare of the whole was £55; but they took up, half-way, 35 more second-class and 5 first-class passengers, and the whole fare now received was $\frac{1}{5}$ as much again as before. What was the first-class fare, and the whole number of passengers at first?—*Colenso.*

Let x = fare of first-class in shillings,

Then $\frac{4x-2}{7}$ = " " second-class " ;

$$\therefore \tfrac{1}{5}(x \times 5 + \frac{4x-2}{7} \times 35) = \tfrac{1}{5} \text{ of } 1100$$

$$= 220$$
$$5x + 5(4x-2) = 440$$
$$x + 4x - 2 = 88$$
$$5x = 90$$
$$\therefore x = 18.$$

$\therefore$ first-class fare = 18s.

second-class " = $\frac{72-2}{7}$s. = 10s.

Again, let x = No. of first-class passengers at first,

Then $x+40$ = " " second-class " " " ;

$$\therefore x \times 18 + (x+40) \times 10 = 1100$$
$$18x + 10x + 400 = 1100$$
$$28x = 700$$
$$\therefore x = 25.$$

$\therefore$ No. of passengers at first = 25 + 25 + 40

= 90.

4. ANXIOUS.—Find the coefficient of x^5 in the expansion of $(1 + 2x + 3x^2)^7$.

In this case,

$$q + 2r = 5, p + q + r = 7.$$

The solutions are $r = 2, q = 1, p = 4$; $r = 1, q = 3, p = 3$; $r = 0, q = 5, p = 2$.

$$\therefore \text{Coefficient} = \frac{\lfloor 7}{\lfloor 2 \lfloor 4} 2^1 . 3^2 + \frac{\lfloor 7}{\lfloor 3 \lfloor 3} 2^2 . 3^1 + \frac{\lfloor 7}{\lfloor 5 \lfloor 2} 2^5$$

$$= 105 \times 2 \times 9 + 140 \times 8 \times 3 + 21 \times 32$$
$$= 1890 + 3360 + 672$$
$$= 5922.$$

5. MOI.—Simplify:—

$$\frac{\left\{(a^m)^{\frac{1}{r}}(a^q)^{\frac{1}{n}}\right\}^{nr}}{\left\{\sqrt[q]{b^m}\left(\sqrt[m]{b}\right)^r\right\}^{mq}} \div \left\{\left(\frac{a}{b}\right)^q\right\}^r. \quad (\textit{Todhunter}).$$

$$\frac{\left\{(a^m)^{\frac{1}{r}}(a^q)^{\frac{1}{n}}\right\}^{nr}}{\left\{\sqrt[q]{b^m}\left(\sqrt[m]{b}\right)^r\right\}^{mq}} \div \left\{\left(\frac{a}{b}\right)^q\right\}^r$$

$$= \frac{\left\{a^{\frac{m}{r}} \times a^{\frac{q}{n}}\right\}^{nr}}{\left\{b^{\frac{m}{q}} \times b^{\frac{r}{m}}\right\}} \div \left(\frac{a}{b}\right)^{qr}$$

$$= \frac{a^{mn} \times a^{qr}}{b^{mn} \times b^{qr}} \div \frac{a^{qr}}{b^{qr}}$$

$$= \frac{a^{mn}}{b^{mn}}$$

$$= \left(\frac{a}{b}\right)^{mn}. \quad \text{Ans.}$$

6. DISCIPULUS.—On the ground are placed n stones; the distance between the first and second is one yard, between the second and third three yards, between the third and fourth five yards, and so on. How far will a person have to travel who shall bring them, one by one, to a basket placed at the first stone?

There are $(n-1)$ journeys; the first is of 2 yards, the second of $2(1+3)$ yards, the third of $2(1+3+5)$ yards and so on.

Thus the first journey is of 2×1 yards, the second of 2×4 yards, the third 2×9 yards, and so on. We have, therefore, to find the sum of 1, 4, 9, etc., that is, $1^2, 2^2, 3^2$, etc., to $(n-1)$ terms.

The sum of the squares of the first n natural numbers

$$= \frac{n(n+1)(2n+1)}{6};$$

$$\therefore \text{Sum to } (n-1) \text{ terms} = \frac{(n-1)n(2n-1)}{6};$$

$$\therefore \text{Distance} = \left\{\frac{n(n-1)(2n-1)}{6} \times 2\right\} \text{ yards.}$$

$$= \tfrac{1}{3} n(n-1)(2n-1) \text{ yards.} \quad \text{Ans.}$$

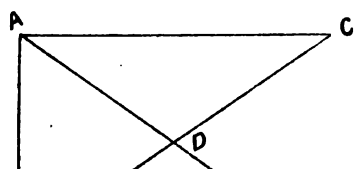
7. J. P. BAILESTONE.—

Solve:—$\left(\frac{x}{x-1}\right)^2 + \left(\frac{x}{x+1}\right)^2 = n(n-1).$

$$\left(\frac{x}{x-1}\right)^2 + \left(\frac{x}{x+1}\right)^2 = n(n-1)$$
$$x^2(x+1)^2 + x^2(x-1)^2 = n(n-1)(x^2-1)^2$$
$$x^4 + 2x^3 + x^2 + x^4 - 2x^3 + x^2 = n(n-1)(x^4 - 2x^2 + 1)$$
$$x^4\{n(n-1)-2\} - 2x^2\{n(n-1)+1\} + n(n-1) = 0$$
$$x^4 - 2x^2 \frac{n(n-1)+1}{n(n-1)-2} + \left\{\frac{n(n-1)+1}{n(n-1)-2}\right\}^2$$
$$= -\frac{n(n-1)}{n(n-1)-2} + \left\{\frac{n(n-1)+1}{n(n-1)-2}\right\}^2$$
$$= \frac{4n^2-4n+1}{\{n(n-1)-2\}^2}$$
$$x^2 - \frac{n(n-1)+1}{n(n-1)-2} = \pm \frac{2n-1}{n(n-1)-2}$$
$$x^2 = \frac{n^2+n}{n^2-n-2} \text{ or } \frac{n^2-3n+2}{n^2-n-2}$$
$$= \frac{n}{n-2} \text{ or } \frac{n-1}{n+1}$$
$$\therefore x = \pm\sqrt{\frac{n}{n-2}} \text{ or } \pm\sqrt{\frac{n-1}{n+1}}. \quad \text{Ans.}$$

Geometry.

1. MATHEMATICIAN.—In a right-angled triangle, show that the distance of the middle point of the hypotenuse from the right angle is equal to half the hypotenuse.



Let ABC be a right-angled triangle, having the angle at A a right angle, and let AD be drawn to the point of bisection of BC.

Then AD shall be equal to half BC.

Produce AD to E, making DE equal to AD, and join BE.

Proof.—In the triangles ADC, BDE, the two sides AD, DC = the two sides ED, DB, each to each,

and the angle ADC = the angle EDB; (I. 15.)

$\therefore$ the base AC = the base EB, (I. 4.)

and the angle CAD = the angle BED.

Because AE meets the two straight lines AC, BE, and makes the alternate angles CAE, AEB equal to one another,

$\therefore$ AC is parallel to BE. (I. 27.)

Because AC is parallel to BE, and AB meets them, the two interior angles CAB, ABE are together equal to two right angles; (I. 29.)

but the angle CAB is a right angle; (Hyp.)

$\therefore$ the angle ABE is a right angle.

Hence in the triangles BAC, ABE,

the two sides BA, AC = the two sides AB, BE, each to each,

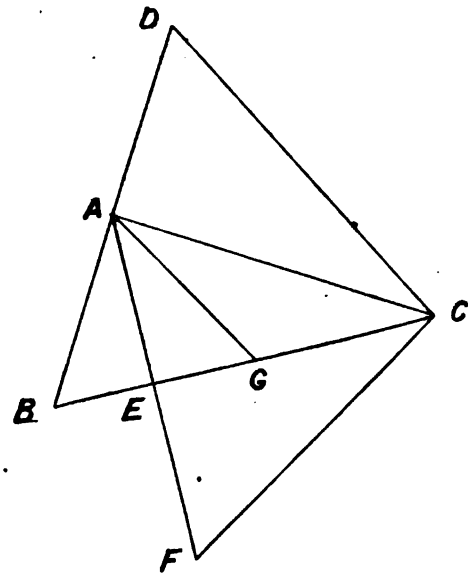
and the angle BAC = the angle ABE; (Ax. 11.)

$\therefore$ the base BC = the base AE;

and AD is half of AE; (Con.)

wherefore AD is equal to half BC. Q.E.D.

2. VIFIONFAB.—If one angle of a triangle be a right angle, and another equal to two-thirds of a right angle, prove from the First Book of Euclid, that the equilateral triangle described on the hypotenuse is equal to the sum of the equilateral triangles described upon the sides which contain the right angle.



Let ABC be a triangle, having the angle at A a right angle, and the angle at B equal to two-thirds of a right angle.

Then the equilateral triangle described upon BC shall be equal to the equilateral triangles described upon AB, AC.

Produce BA to D, making AD=BA; join DC.

Then BDC is an equilateral triangle described upon the hypoenuse BC. (I. 4 and I. 6.)

Draw AE perpendicular to BC, and produce it to F, making EF=AE, and join FC.

Then AFC is an equilateral triangle, (I. 4, I. 32, and I. 6), and it is described on AC.

Lastly, cut off from EC, a part EG=EB, and join AG; then ABG is an equilateral triangle described upon AB.

Proof.—Triangle AFC=twice triangle AEC,
and ,, ABG= ,, ,, ABE;
∴ Triangles AFC, ABG=twice triangles AEC, ABE,
=twice triangle ABC:
but triangle BDC=twice triangle ABC;
∴ Triangle BDC=triangles AFC, ABG. Q.E.D.

[We regret to state that the answers to several queries must be held over till our next issue.]

—o—

ANNUAL DRILL COMPETITION OF BOARD SCHOOL BOYS.—The annual drill competition of boys from Board Schools for the challenge banner given by the Society of Arts took place on Saturday, July 29th, by the permission of the Archbishop of Canterbury, in the grounds of Lambeth Palace, in the presence of Mr. E. N. Buxton, the chairman, and several other members of the Board. Only eleven schools out of the whole number competed. The boys were put through various evolutions by Mr. Sheffield, the drill-master, including a march past in open column, formation in fours right and left, wheeling in companies, marching in line and counter-marching, and finally were drawn up in square, when Mr. Buxton said they had all done well, and he had had great difficulty in deciding which had done best, but he must award the banner to the Portman Place (Mile End) School, which held it last year, and he thought the Medburn Street (St. Pancras) School came next. The boys thereupon gave three cheers for Mr. Buxton and three more for the Board, and then marched out of the grounds.

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Vice-President of the British Medical Association.

VIII.

DISEASES OF THE SKIN—*(continued).*

IT will be right before dismissing the subject of skin disease to lay down some general rules of diet and some directions which may be observed in most cases of the kind.

Breakfast should consist of bread and milk, or rice-milk, eggs, fresh fish, and bread and butter. Tea and coffee are best avoided.

Dinner should be plain roast or boiled fresh meat, fish, poultry, milk and egg puddings. Farinaceous puddings, boiled rice, potatoes and fresh vegetables, as fresh beans, cauliflower, etc., well cooked.

The evening meal should be milk or gruel, or other farinaceous food, bread and butter, poached eggs, toasted bread, perhaps a little cream cheese. It is better to avoid other kinds of cheese. Barley-water, thin water gruel, beef tea, and any of the mineral waters which are usually drunk should be the only beverages. Whilst salt meats, pepper, pastries, raw vegetables, spirits and malt liquors are not to be touched.

It will be right also to give a few directions as to clothing. The first condition to be observed is, that cleanliness of person shall be rigidly observed, and although flannel is sometimes necessary to be worn, it is not always judicious when there is the least discharge of moisture or exfoliation. It is best to wear soft linen next to the skin. It is not a good plan, however, to wash over diseased skin more often than is absolutely necessary, but other parts should be washed frequently, using as little soap as possible; whilst it should never be used at all on the diseased surface. The scalp may be cleansed with yolk of egg and warm water, and other parts of the body when diseased are more satisfactorily treated with thin gruel, or oatmeal and water, or water in which bran has been boiled, or even warm milk and water may be used. In drying diseased skin, it is very necessary to avoid friction. Use soft linen for the purpose, and dab it, rather than use any kind of scrubbing process. By this kind of treatment we may avoid injury to the new skin, so as not to displace the altered parts until a new formation has taken place. Ointments and greasy lotions may be removed by these kinds of application better than by any other means, although poultices are sometimes necessary.

ABSCESS.

Abscess.—It is not uncommon to find a child suffering from the effects of an abscess, or gathering (as it is often called), in different parts of the body; an inflamed part is said to suppurate or gather when it softens in the centre and matter or pus collects in it. It is one of the results of inflammation, and may take place anywhere. In some parts they are comparatively unimportant; in others they are highly dangerous, and must not be neglected. Matter forms in the first instance in consequence of some defective vitality in the part affected. The white corpuscles which are contained in the blood, wander out of their usual channel, and become deposited in the part which has a lower vital power. The depressed vitality may have been produced by injury, or over-excited action, or by close proximity to some other damaged part and in which the mischief extends by simple contact. The symptoms which indicate the formation of matter divide themselves into two classes, (1) those which are acute or rapid in their development, and (2nd) those which are chronic or of slow growth. In the first class of cases, there are the usual symptoms of inflammation, heat, swelling, pain, and as the matter approaches the surface, redness. When suppuration has really commenced, the pain gradually loses its acute form, and becomes more dull and throbbing; the hardness, which was considerable at first, decreases; the swelling becomes softer and an elevation takes place in the skin, which indicates that the matter is pointing to the place at which the abscess intends to open; the point assumes a conical form, the skin reddens and becomes thinner, and at length the abscess discharges a quantity of pus, or matter and the swelling subsides at once. If the suppuration is considerable, or if the part suppurating is a very sensitive one, there is more or less constitutional disturbance. The fact of suppuration is often preceded by a shiver or rigor, and some feverishness, which is indicated by quick pulse, hot skin, and furred tongue, with loss of appetite and

general *malaise*, which will be more or less according to the character of the abscess. The discharge of the matter from the abscess will be followed at once by the diminution of the constitutional symptoms.

In *chronic abscess* the constitutional symptoms set up are often very slight; sometimes a very large abscess forms without producing any apparent change, and one is surprised at the quantity of matter which may escape, either by accident or design, from a given swelling. It is necessary to determine the nature of a given collection of matter before deciding as to treatment. If it is the sequence of an accident, and the result of neglect, very simple means are requisite for its cure, unless the constitution of the child is bad, and the surroundings at home in an insanitary condition; in that case, very slight injuries and small abscesses may lead to very serious results. It is a very common idea to suppose that it is best to open a gathering and let out the matter as soon as possible; some surgeons even are always glad of the opportunity to use the knife. This is an error. There are occasions when it is right and justifiable; but, as a rule, nature will do the work better than the surgeon, and the discharge will take place at the proper time and in a proper manner. The discharge may be assisted by poultices, but their use is as often mischievous as beneficial. They should only be used when the skin is sensitive, when there is increase of swelling, and redness commencing, and some tension of the neighbouring parts. As soon as the discharge has been free, and the inflammatory tenderness has subsided, the poultice should be left off, and some antiseptic dressing applied and treatment pursued as directed in the case of boil or carbuncle. There are five different conditions in which it may be prudent to obtain the surgeon's aid in the treatment of an abscess. (1.) When matter forms beneath fascia or dense ligamentous structure, such as the neighbourhood of the joints in the fingers or deep fascia of neck. (2.) When it is caused by some unhealthy matter, as follows from the bite of some animals, or when diffusing rapidly, as in some carbuncular states. (3.) When it is in very loose cellular tissue, as in the armpit. (4.) In suppuration in highly sensitive organs, as in the eye or under a finger or toe-nail; and (5) whenever it is desirable to avoid a scar. In the majority the aid of the surgeon is required for the general treatment, as well as to open the abscess. In chronic abscess it is best, if the quantity of matter is large to have it removed by means of the aspirator, by which the matter is evacuated without the admission of air, and the danger of subsequent blood-poisoning is materially diminished. The indications for treatment in chronic abscess are to amend the general health, to promote the absorption of the matter; but if it has to be let out, to take care that the sac or containing cavity is speedily obliterated.

Small abscesses are frequently unnoticed, but they are very often the source of blood-poisoning, and give rise in the end to very serious illnesses, and even fatal consequences, by the septicœmic or general blood-disorders which follow from the changes which are induced in the blood by septic germs finding admission into the system. Small scratches upon the body, slight punctures, or forgotten injuries are often the means by which mischief results a few weeks or months afterwards. It is right, therefore, for the school manager to note these abrasions, and compel the children under his charge to attend to them, to keep them clean, and to prevent as much as possible contact with the outer air until the abraded skin has completely healed. Some popular remedies, as the inner skin of an egg-shell, goldbeaters'-skin, lily leaves, and other simple applications are beneficial whenever they effectually keep out the external air from an abraded surface.

Whitlow.—One of the most common sources of mischief is a whitlow; this is an inflammation at the edge or root of a finger or toe-nail. It is often set up by a so-called hang-nail, a small piece of skin which has been detached from the edge of the nail by violence, and which is allowed to be irritated by dirt or continued rubbing; it soon becomes very painful, and, unless treated properly, is liable to end in abscess or other mischief. All the symptoms of an acute abscess arise, and the child is not in a condition to do his school work. It is the usual custom to poultice these swellings, and to promote the formation of matter by increasing the inflammation in the part. This is wrong treatment. The best plan is to keep a little cold water upon the finger—to apply a piece of wet lint around it. Keep it cool by frequently dipping it in a glass of water, and not covering it up with oil silk as is frequently done, but let the water constantly evaporate, so as to keep down the inflammation. In a few hours, or at the most, a day or two, a small white spot will be observed by the side of the nail containing pus, which may be evacuated by means of a needle passed through the white part. The pus will escape into the lint. The cold water should be continually renewed until all tenderness is gone, the part kept studiously clean, and as soon as tenderness has departed let it be kept covered up with a finger-stall, having previously applied a small quantity of Turner's cerate (calamine ointment) upon the edges of the nail to keep it moist, and so allow any discharge to escape. If the pus is deep in the tissues, or pressing on the bone, it must be let out by the lancet, but it will seldom happen that cold water, if applied soon enough, will not be able to prevent the development of this mischief; of course it will be requisite to avoid all games such as cricket, or fives, or marbles, or anything else by which a bruise may result to the finger. It is important to observe that it is only the inflamed part which is to be kept cool. The cold water is not to be applied to the whole of the finger, for if this is done vitality is reduced too much, and mischief may result. The hand is not to be chilled altogether. The same treatment must be used when the toe is the seat of the disease. It generally arises in the great toe-nail, and in those cases has followed in consequence of an injury to the nail in kicking at football or other games, and the wearing a boot or shoe which is too small for the toe. It is curious to note the general neglect which is shown by parents and bootmakers to the natural position of the toe, and the necessity for allowing for its natural growth. There is no room left for this. The growing boy has a new boot made which is just long enough to contain his foot, but there is no allowance for that half inch which will probably be added to the foot in the course of the next four months, and, as a consequence, the toe-nail is pressed into its tender quick, or the toe itself is bent out of its proper position, and the foundation laid for a bunion in future years.

A new boot for a growing boy or girl should always be at least from half an inch to one inch longer than the foot of the wearer.

It is very important to avoid pressure of every kind upon those small abrasions or gatherings which will sometimes arise from injury to the feet; water applications, provided they are frequently changed, will be better than poultices, though these latter are sometimes necessary when there is much tenderness and great heat; but small abrasions are best covered up with chamois leather, spread with soap plaster, and by that means fresh injury prevented.

Styes.—These are small abscesses which form at the edge of the eyelids; they proceed slowly to suppuration, and are often very painful. When the pain is great a cold bread-and-water poultice for twelve or twenty-four hours is the best thing to be done, and after discharge has taken place, to touch the discharging part with a minute portion of yellow basilicon ointment, taking care that none of the ointment gets on the mucous membrane of the eyeball; it would do no real harm if it did, but would cause a little unnecessary smarting. Styes are an indication of a low vitality, and show that the blood is out of order. The eye should not be used by reading or writing when it is inflamed from the close proximity of a sty. If the lashes are matted together with small scaly bits of cuticle, it is advisable to touch their roots every night with a little citrine, or golden ointment, and bathe them well in the morning with cold rain-water, and the scales removed from the eye-lashes.

The digestion should be attended to, some alkaline aperient given, and care used in regard to diet.

Quinsy is another form of abscess, which has its origin in the tonsils; it generally arises from taking cold when the blood is out of order, and a perspiration, which was carrying out of the body some morbid matter, has been checked, and the discharging material thrown back into the circulation. Sometimes a herpetic eruption forms on the lips; in other cases, instead of appearing on the lips, it affects the tonsils. The follicles or glands in these organs take on an inflammatory action, and ultimately suppurate It is very important for the schoolmaster to be able to recognise a quinsy at once, and not to mistake it for some more mischievous form of disease, such as scarlatina or diphtheria, and then to frighten himself out of his life. The one is not infectious, the others are. Quinsy is a corruption of the term cynanche, which means inflammation of the throat, and in olden times included croup, diphtheria, pharyngitis, tonsilitis, and some forms of scarlatina; it is now restricted to inflammation of the tonsils. The gland swells, there is painful deglutition, the child cannot swallow comfortably, and, on inspection, one tonsil is seen to be larger than the other; the enlargement has been generally preceded by a chill, perhaps a rigor or shivering, and the child is out of sorts; but there is not at first the direct fever which attends an eruptive disease. If the thermometer is used it does not give that high temperature which indicates scarlatina, seldom exceeding 100°, and it is very different, on inspection, from diphtheria. In this latter disease the throat is altogether red and glassy-looking, or there is a distinct leathery-looking membrane forming upon one or both tonsils, perhaps extending to the velum on the uvula, whilst, in quinsy, there is no appearance of membrane. The tonsil looks at first rather paler. It does not show very decided redness until the enlargement is manifest, and the difficulty of swallowing considerable. In diphtheria the swallowing is not at first much interfered with. Acute pain on swallowing is much more likely to be quinsy than anything else. Sometimes we see an aphthous state of throat, consequent upon some blisters on the tonsils, which seem to be the analogue of herpes on the lips. The blisters form on the surface of the organ, instead of leading to suppuration inside. These conditions are closely connected with digestive disturbance. There is generally a foul tongue, severe headache, loss of appetite, and confined bowels. A good dose of calomel and James' powder, in the proportion of two grains of each, is the best treatment, with a saline purgation on the following morning. If quinsy is forming, it is best to use a warm fomentation to the throat, to inhale steam frequently, and to encourage the discharge of matter as quickly as possible; but as soon as discharge has taken place, to gargle with cold water. Caustics and actively astringent applications are generally injurious, though frequently practised. They tend to weaken the throat, and render the patient liable to similar attacks.

(To be continued.)

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

'LIQUIDS under pressure.' We come now to a part of the subject that seems to furnish a wide field for the display, on the part of both text-book and teacher, of an astonishing amount of mistiness. It is very seldom I hear a teacher giving a lesson upon 'Liquids under pressure' or upon 'Liquids under gravity' before I soon become painfully aware of the fact that the teacher is not quite sure what it is he is talking about. 'The Representation of Chaos' at the opening of Haydn's oratorio is not out of place. But to attempt anything of the kind in a lesson on 'Mechanics' betrays a dim perception of the necessities of time and place. The confusion seems to arise, 1st, from the want of a clear understanding as to what 'gravity of liquids' really means; 2nd, from failing to distinguish between the pressure of a liquid due to gravity and the pressure due to the transmission of a force mechanically exerted upon some part of its surface; and 3rd, from the possession of the singular notion, or comical idea, that the pressure of the atmosphere of 15 lbs. upon every square inch, is exerted upon the exposed surface only of a liquid, and is in some way or other transmitted throughout the liquid and then exerted upon the bottom and sides of the containing vessel. I once heard a teacher giving a lesson upon 'the gravity of liquids and the hydrostatic press.' Now the hydrostatic press has nothing to do with the gravity of liquids. By the gravity of a liquid, as indeed of every other mass, we mean its tendency to fall to the earth's centre; and when anything intervenes to intercept the body, then pressure is produced. The intensity of the tendency,

and so the amount of the pressure, depends upon the mass of the body. Weight is a measure of mass; so weight is a measure of the pressure due to gravity. If I fill a cylinder with water, there is a certain pressure upon the sides and bottom of the cylinder, due to the gravity of the liquid. If now I press down a water-tight piston upon the surface of the water, the pressure I thus mechanically exert is transmitted, and acts upon every part of the inner surface of the containing vessel. This latter pressure is the kind of force utilized in the case of the hydrostatic press, and is quite distinct from pressure due to gravity. All this can, by the aid of a few experiments, be easily grasped by children. A sharp boy is sure to ask what is the difference between the pressure of a liquid and that of a solid. To show the difference, cut a small cube of chalk, to exactly fit into a small box, of which the sides can be easily removed. Say the chalk weighs 4 lbs. The boys will soon see that the whole of this 4 lbs. presses against the bottom of the box—none against the sides, or they would be pushed away, being easily removable. This is simply because it *is* a solid, *i.e.*, its molecules are firmly held together by the attraction of cohesion; and so the mass retains its shape, even after you remove the sides of the box. Now fill a similar box with water, in one of the sides of which a hole has been bored and a cork inserted. Ask now whether the pressure is exerted at the bottom only of the box, as it was in the case of the solid; the boys will answer 'No.' Show by removing the cork that there *is* a pressure upon the sides, causing the water to rush out. If several holes, at various heights in the side are bored, the boys will observe how the pressure increases with the depth of the water. Incidentally remark, as to the construction of reservoirs, that the sides are made thicker at the bottom than at the top. All this has to do with 'the gravity of liquids.' Now take the cube of chalk, place it in the box, exert a pressure upon the upper surface of the block, and get the boys to see that the whole of that pressure is transmitted and borne by the bottom only of the box—none by the sides. Then by means of diagrams, or if possible by working models, show by filling with liquid a water-tight vessel closed on all sides with the exception of two or three cylinders of equal diameters, in various parts of the sides and top, into which cylinders pistons are fitted, that if a pressure, say of 4 lbs., is exerted upon the piston in any one of the cylinders, every other piston in any part of the containing vessel is forced outwards with a force of 4 lbs. In this way the boys are led up to the conclusion that 'pressure upon a liquid is transmitted undiminished and in all directions throughout the entire mass.'

The next point to make clear is this:—'That if a pressure of, say 4 lbs., is exerted upon any square inch of a liquid, that pressure is transmitted to every square inch of surface in contact with the liquid.' For instance, in the cylinders above alluded to, if one of the pistons were one square inch in area, and one of the others 4 square inches, then if I place a 4-lb. weight upon the smaller piston, the other would be pushed outwards with a force of 16 lbs. A boy will sure to remark here, that the 4-lb. weight sinks farther down than the 16-lb. weight rises. It can easily be elucidated *how much* farther; and so the teacher will soon lead to the fact that this is an instance of the 'dispersion of force, but not of its creation.' Reference will also be made to the analogous conclusion in the case of the mechanical powers, viz., that 'force is gained at the expense of time.'

During my lesson upon this subject, an exceedingly thoughtful boy raised his hand, signifying that he wanted to speak: he unburdened his mind of a difficulty. I was greatly delighted with what he said, especially when I found that other little minds had been similarly exercised. He spoke to this effect: 'If what you say is true, sir, then if I place that box of water in one pan of a pair of scales, and put weights in the other pan to exactly balance; then suppose that cylinder is one square inch, and the bottom of the box 100 square inches; if you place a 4-lb. weight on the piston, there must be 400 lbs. pressing against the bottom of the box, and therefore pressing down the pan of the scales; and yet only another 4 lbs. on the other pan will balance, because after all you have only added 4 lbs. more on to the scale with the box. How is this?' 'I should have thought,' continued the lad, 'that if there is 400 lbs. more pressing on the bottom of the box it would weigh 400 lbs. heavier.' I took up the boy's difficulty, and soon got it removed by the other boys, until we arrived at the conclusion that this supposed puzzle arose from leaving out of consideration the pressure *upwards* against the top of the box, which counteracted or took off the pressure on the bottom. Altogether, this subject formed most excellent material for thought training. Every now and again points were presenting themselves which would set the whole class thinking most profoundly; and it was in the highest degree pleasing for me to note how the general current of intelligence in the whole class flowed on like a river towards the ocean, gathering at each turn fresh thoughts and new truths, widening and deepening until it reached the broad generalization or universal law.

(To be continued.)

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Eminent Practical Teachers.

DAVID STOW,

Founder of the Training System of Education.

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

II.

THE prejudice against 'the newfangledsomed notions' of teaching expressed by Granny in the extract last quoted was very common, but the 'weans' were themselves so delighted—as they always are in a *true* infant school—that they 'wadna come out.' A Shakspere would not have seen

> 'The whining schoolboy, with his satchel
> And shining morning face, creeping like snail
> *Unwillingly* to school'

in the Drygate. 'Wee Geordie' and his companions 'got sic grand fun, mairchin' and swingin', and I canna tell ye what a', that' their parents 'were just obleeged to let them gang their ain way.' The 'baubees' required at the school were found to

be economically expended, and soon the mothers confessed that they, at least, had 'na muckle objection to the chainge.' Granny had heard of instruction about 'horizontails and perpetriculars' and other matters which she confessed 'are clean ayont my comprehension.' During the visit referred to, the old lady, looking round inquiringly, said:

Granny. My sight's no that gude, Maister, but just since I put on my spentacles, what kind o' pictures are these on the wall next us—a monkey, and syne a teeger, and then another broad wi' L's and C's, and black scores scartit hither and thither, like lines in a wean's first copy (geometrical figures). How can ye reconceel monkeys, and sic like trash, wi' religion, and teaching weans richt ways, as they tell me ye do? And gin ye stock their heads full o' sic nonsense, what room will there be for the—'great and important truths?'—Man, I'll be plain wi' ye—I am very angry; but I ken that's no richt, for patience is a virtue, they say—is it no?

Master. Now, Mistress, I must say one word. Whether, think you, is it preferable to keep the children, as you say you were kept, three hours at a time fixed to your seat, and perhaps only twelve or fifteen minutes of which you were employed repeating the mere sound of the words of your lesson, labouring away at a dry subject like the A B C, or, as these children are, employed every minute at something that is improving to body or mind—learning the proper use of everything, and even what monkeys and tigers are in their nature and dispositions. Allow me to say, Mistress, our object has been to give to the Infant Training System a thorough Scriptural basis, and this is not a difficult task if we but consider the wideness and extreme variety of the range, embracing as it does the foundation and elements of much that is most interesting in nature and in art.* It is true we amuse the little ones, for what child will learn much, or attend to any instruction, without amusement? frequent exercise and activity, you know, add to the children's health; and I believe you will grant that the promotion of cheerfulness and health is perfectly consistent with the Scripture precept, 'Train up a child in the way he should go.'

Granny. Ay, ay, perfectly consistent, to be sure—bears, and lions, and girnin' wolves, and a' these kind of cruel beasts; there's a heap o' Scripture in them, Is'e warran'.

Master. Well, Mistress, can you say these animals are not spoken of in the Bible? And are the names and dispositions of both wild and tame animals not often used there to illustrate moral and religious subjects?

Granny. Weel, I'll no say; but I think, Maister, the less ye teach the weans about sic beasts the better, at least in a schule. I aye thought they were kept in dens in a show-box. Let everything gang to its richt place, Maister; wha e'er heard o' a schule for teaching about wild beasts?

Master. I entirely differ from you, Mistress; for as animals of various kinds, not only lions, bears, and wolves, which you particularly mention, but other beasts, birds, reptiles, insects, and even fishes, are frequently noticed in Sacred Scripture in reference to their peculiar qualities, why then should not these children be made acquainted with their nature, dispositions, and use? For example, 'Be wise as serpents, and harmless as doves.' Unless children first know the peculiar character of the serpent, and also of the dove, this passage to them is of no practical use. The same may be said of a thousand other passages of Scripture. The Bible refers not only to wild and domestic animals, but to very many things in nature and the arts, in the common and ordinary affairs of life—all of which we teach the children. But, independently of these considerations, if you don't employ the children's time in learning good, they will employ it themselves in learning evil. Why, then, not occupy a portion of it in exploring the power, wisdom, and goodness of God in the animal creation, as revealed in the Bible? Never forget this, Mistress, that, except when asleep, the mind of a child, as well as his body, is never idle—all is activity. We would not teach secular science from the Bible, any more than we would teach reading from that sacred book, but we would teach as much as would enable the children to understand the meaning of the passage read and intended to be illustrated by the particular emblem, such as of an animal for example. Children are so fond of Scripture training lessons, that when liberty is granted by the Master, they eagerly call out for a Bible lesson.

Granny. Weel-a-weel; but are ye no keeping ower muckle amang the beasts, Maister? I'm sure it's no beasts the Bible was written for.

The question of religious exercises in schools was keenly discussed outside the Educational Society. Mr. Stow indicated his principles in the following dialogue:

Granny. Ay, but, Maister, ye maun excuse me ance mair, for atwell-a-wat I'm but a poor doitit bodie, and maybe no sae weel learnt as my son, or the like o' you—but the prayer, man—I was amaist gaun to be as graceless as yersel'—ye hae forgot *it*, hae ye na? Can ony blessing be expected to come out-owre this, or onything else, if we dinna leuk up and ask a blessing?

Master. Now, Madam, I find you are really very sharp with me, but I excuse your anxiety, and must respect those sturdy principles by which you, unlike some of your younger matrons, appear to be actuated, and therefore I shall also explain this matter as you desire.

Granny. Thank you, Sir—ye're very discreet, *considering.*

Master. You must know, Madam, that I always open as well as close the school by prayer and singing a hymn. We also teach the children to repeat the Lord's Prayer;* and, of course, *previously exercise them on its meaning.* It must, we conceive, be important that these children, in the dawn of their reason, use that comprehensive prayer which the disciples of Christ, in their little more than infant knowledge of its great meaning and comprehensiveness, were commanded to use. I say this, Mistress, lest ye be one of those who say that children ought not to be taught to pray.

Granny. Na, na, ye mustna think that o' me, Maister. No learn weans to pray! I wonder wha would say that? Is na prayer ane o' the ways the sinner gangs to God? and, gin we dinna teach them to pray, how can we train them up 'in the way they should go?' Na, na, dinna think that o' me, Sir.

Master. You'll excuse my being particular; *for although my attention is not, and would not do to be, taken off so much as at present by every one who pays us a visit,* yet you seem so smart that I am obliged to be very much on my guard what I say before you, without explaining it. The prayer, goodwife, was at half-past nine o'clock precisely; after which, and previous to going out to the playground, the children had half-an-hour's Bible training in the gallery.

Another lively dialogue justified the introduction of 'secular' instruction, for there were some who thought that in schools for the poor the Bible should be the sole text-book. That prejudice is, after half a century, dead and almost forgotten. But we must quote no more.

About the year 1828, the Glasgow Educational Society, at Mr. Stow's suggestion, invited Mr. Samuel Wilderspin, of London, to deliver a series of lectures on the methods of Infant Schools. The experience of so successful an infant teacher was, at that time, most valuable, and Mr. Wilderspin's visit to Glasgow and Edinburgh increased the interest in popular education which had been already excited, and served to attract special attention to the merit of separate schools for infants.

Mr. Stow's chief aims, however, were different from those mainly contemplated by the system then advocated. He sought to secure, not only high intellectual results, but also a change of moral character. In his school, children on the lowest social level were, during school hours, separated from the tumult of iniquity which prevailed in their bye-streets and lanes, and were taught new forms of mutual intercourse. The change wrought in the physical appearance and intellectual aptitudes of these children gratified many observers; but Mr. Stow, looking to the inner life, or moral history, sought *there* evidences of improvement. Their changed character could not be *exhibited;* no

* The emblems of Scripture, in particular, are conducted two mornings per week, as distinct oral training lessons to the whole pupils in the gallery, and from each of which valuable practical lessons are drawn. During the process of picturing out these (in words), innumerable allusions to *ordinary life and common things* are, of course, brought under review, and analysed in the most simple terms—in the first instance as it were—*broken down into crumbs*, and in the juvenile and senior departments in *rather* more complex terms. *We all know that the spiritual teaching of the Bible is communicated through natural objects and things;* and practical Christian duty by examples as well as precepts. The picturing-out principle of Bible training, therefore, is invaluable to the young.

* This is repeated simultaneously in one voice, very slowly, distinctly articulating every syllable, and making a sensible pause between each word—not rapidly rattling it over as is frequently done.

examination could bring out moral results, and thus the higher aims of the experiment in the Drygate School were, as yet, unappreciated. The most distinctive part of his system in relation to other infant schools was, at that time, the hold which, by Bible truth, he sought to take of the early moral life, that it might be moulded anew. In dependence on the Divine blessing, he made the daily Bible lesson, explained and enforced on principles which he had laid hold of in his Sabbath-school, the basis of his system of moral training. All conduct in the 'uncovered school' was habitually referred to the instructed consciences of the collected children, and the distinction between right and wrong being perceived, there was established in the 'little world' a common sentiment, which the 'sympathy of numbers' firmly maintained. Infants from the Drygate learnt to be truthful, honest, and forbearing; flowers bloomed in the small garden-strip which edged the play ground, and pendent currants ripened within the reach of children who had, in this training school, early acquired the power of self-denial.

A reaction of public feeling which followed certain extravagant exhibitions of the mental capabilities of children so far removed sympathy with the work as to render the raising of £150 for the Drygate school impossible. Mr. Stow, having faith in his principles and in himself, not only accepted this burden, but obtained a large hall in the Saltmarket, with space for *playgrounds*, always insisted upon as essential to his methods of moral training. Here, again, he laboured almost unaided, but with a confidence of success which was enduring. In 1834 nearly a hundred teachers had been 'trained,' and in order to carry out his system with older children, he purchased a playground for the St. John's Parish School, which, as 'the juvenile school,' was soon filled with children over six years of age, and afforded to the increasing number of students further opportunity of practice in the methods of instruction. Queen's scholarships were then unknown, and each candidate who came for a few weeks' training was soon quickened into enthusiasm, and gave himself or herself wholly to the study of the *greatest effectiveness in the methods of instruction and moral training*. The Rev. J. Auld was Mr. Stow's chief coadjutor at the St. John's School.

The impulse derived from infant exhibitions was, as we have seen, very short-lived; but in these new schools Mr. Stow presented to the minds of educationists something which could be estimated, and which was capable of being embodied elsewhere. Men of highest influence were brought to acknowledge the power of the principles here exhibited in practice, and freely offered the sympathy and co-operation which had been so long withheld. The Glasgow Educational Society, for some time inactive, was reconstituted, lectures were delivered to crowded audiences, and 'the common school was advanced.' Chief among the objects now proposed was one 'to maintain a Normal Seminary in connection with our parochial institutions for the training of teachers in the most approved modes of intellectual and moral training, so that schoolmasters may enjoy a complete and professional education.' In March, 1835, the Society adopted as their own the Model Schools hitherto maintained by Mr. Stow, who, in this fact and triumph, had his highest reward. The first formally-instituted Normal School in Great Britain—one which issued diplomas of skill in method to students who had satisfied prescribed conditions—was that originated by Mr. Stow. St. John's, Battersea (the first founded in England), was established by Sir James Kay Shuttleworth and E. C. Tufnell, Esq., in 1840. The Regulations of the Normal Seminary, drawn up in 1828, provided: (1) That *every* student be trained in the Model Infant School, that he may be thoroughly initiated into the system of Moral Training. (2) That each candidate engage to remain at least three months, in order to secure a diploma; (3) That he (or she) possess a certain amount of elementary education; (4) That each applicant for admission produce a satisfactory certificate of moral character; and (5) That each student be subject to the Regulations of the Model Schools and to the direction of the Model Superintendent.

Teachers who wished to improve themselves were allowed to visit the Model Schools for shorter periods, but not less than six weeks. Among those who sought the diploma were many who had previously passed through the University.

The two Model Schools—'infant' and 'juvenile'—were a mile apart, and this inconvenience was so increased by the crowded state of the class-rooms that a new building became indispensable. Repeated appeals to the Lords of the Treasury having long remained unanswered, the Glasgow Society raised £2,260, and 'began to build.'

On November 14, 1836, a procession of five hundred of the leading citizens of Glasgow wended its way through the city to witness the laying of the foundation-stone of the Normal Seminary. It was headed by members of the University, the chief magistrates, and distinguished ministers, who, by their presence at this ceremony, showed their interest in the intellectual, social, and religious welfare of the people. 'Bible-training in schools' and the 'practical training of schoolmasters' had been distinctly avowed by the Glasgow Society as two elemental principles necessary to the progress of true education; and on this 'historic day' these principles received public acceptance. Normal schools, however, were 'new,' and did not 'command' the needed funds. Still, Mr. Stow persisted, and in the summer of 1837 four Model Schools—initiatory, junior, senior, and industrial (for girls)—were opened, each fully furnished and 'assigned to first-class workers.'

Mr. John M'Crie, a distinguished scholar, was chosen as the first rector of the new Normal Seminary, and began his labours in Glasgow in November, 1837. He had been deputed to visit the chief educational institutions on the Continent, but testified, on his return, that nowhere had he seen any which, in efficiency and completeness, were so far in advance as those based on the principles and methods of Mr. Stow's system.

Sir James Kay Shuttleworth (then Dr. Kay) and E. C. Tufnell, Esq., who, in the discharge of their official duties, had been impressed by the influence which the '*trainers*'—masters and mistresses—had over the young, visited Glasgow at this time in order to see the working of the system under Mr. Stow's personal supervision. They were both much gratified, and many additional trainers were introduced into the schools connected with the Poor-law Unions in England, then largely under the control of the enlightened Christian gentlemen. Dr. Kay in his

evidence before a Select Committee of the House of Commons, in 1838, described the Glasgow Normal Seminary as 'the most perfect school with which he was acquainted,' as affording opportunity both for the acquisition of theory, and for the practice of the methods of instruction. He added, that whilst in Scotland persons might be easily found who were sufficiently educated to enter at once as students of the system, it would be difficult to find a similar class of candidates in England, and urged that measures should be adopted for preparing young men and women by preliminary courses of elementary instruction, to enter upon a subsequent study of 'methods' for at least 'eighteen months.' He also stated that the students then at Glasgow were persons of 'strong religious convictions,' and were 'under the influence of religious sentiments.' He believed that the difficulties of establishing a Normal School in England were not insurmountable, and with reference to the question of moral training, said: 'From the experience I have had, I am inclined to think, that if systematic arrangements were adopted for superintending the conduct of the children in the playground, and for the whole course of moral training pursued in the school, that the difficulties of making that part of the training of a young child efficient in a large school are greatly exaggerated by those who have not had an opportunity of witnessing the success obtained in such schools.'

He applied these remarks also to the higher class of schools, adding that 'although it may require a larger amount of intelligence, and superior vigilance and activity on the part of the master, yet his opportunities, not merely of inculcating moral lessons, but of forming good habits, are increased by the accidents which occur when numbers are assembled, and which develop the peculiarities of character, and especially the moral tendencies of different characters, rather than in a small school.'

This evidence was taken fully eight years before the appointment of the first pupil-teacher, and foreshadowed the 'Minutes' of 1846, which, pervaded by the spirit of Dr. Kay during fourteen years, gave a vast impulse to popular education in Great Britain, and added to the name of Sir James Kay Shuttleworth a lustre which will not grow dim for many generations.

By Mr. M'Crie's early and lamented death, the whole weight of the institution again rested on Mr. Stow, whose incessant labours nearly exhausted his physical strength. In the midst of these toils, the Committee of Privy Council offered him the first inspectorship in Scotland. Many have regretted that he declined the offer, as a position of such influence would have enabled him to show, over a large area, the effects of his system of Bible-training. He did not 'like to be paid for services in any shape,' and, besides, the failure of his health prevented his undertaking the arduous work of an inspector. He humorously paraphrased the caution of his medical adviser, saying: 'If I do not pull in, I must be stretched out.' Still, he was constantly in attendance at the Seminary until November, 1839, when the rectorship was accepted by the Rev. Robert Cunningham. This gentleman had practical acquaintance with the best schools on the Continent, and also in the United States, where he had been a professor. Much needed relief was, however, secured by this appointment. From all quarters there came demands for 'trainers,' which could not be met. In 1840, the Wesleyan body planned a scheme of education, and adopted the 'Moral Training System' for their day-schools. All their 'students' were sent to the Glasgow Normal Seminary for about six months' training, until they opened their own Institution at Westminster in 1851. During that interval of ten years about four hundred and forty teachers were trained by Mr. Stow for Wesleyan schools in England.

The class-rooms were crowded with students, whose minds and hearts offered ready sympathy with the objects of the Training system, and who, in the presence of its visible effects, were soon subject to the prevailing enthusiasm. Mr. Stow's stated visits to conduct the private and the public criticism lessons were prized opportunities of culture. His exposition of principles, illustrated on those occasions by practical examples, furnished what was most necessary to a teacher's professional success. His earnest zeal was contagious, and every man and woman who completed the course at the Normal Seminary, short as it was, quitted Glasgow, nevertheless, in conscious possession of a power to 'do good' in the methods there acquired. The elasticity of the student's mind was not injured during training by any anxiety about prospective examinations, for examinations for certificates were then unknown. Each student at that period paid his own expenses. All his time and energy were devoted to the study of the 'normal' theories, and to their practical illustration in the model schools.

In 1840 the Rev. Robert Cunningham resigned the Rectorship. The debt on the new building exceeded £10,000, and as the educational enthusiasm of the time proved to be effervescent, and appeals for aid were fruitless, the double burden of extra work and anxiety weighed heavily on Mr. Stow, and for a time rendered extension and improvement impossible. After a long correspondence, the Privy Council agreed, on December 31st, 1841, to make a grant-in-aid to the extent of £5,000, but on condition that the Normal Seminary should be handed over to the management of the Church of Scotland. In the stress of their financial difficulties, the Educational Society reluctantly yielded. Before the remaining portion of the debt could be discharged, however, there occurred, in May, 1843, a disruption of the Established Church of Scotland, by the secession of five hundred of her ministers; and this event, the particular history of which would here be foreign to our purpose, led ultimately to the necessary abandonment of the building. Mr. Stow and the staff of teachers generally had become adherents of the Free Church, and when, therefore, it was officially notified, that in future the members of the staff must be in communion with the Established Church, there was no possibility of their remaining in the Seminary. Mr. Stow for two years earnestly strove to avert this catastrophe, but in vain. It grieved him to the last to have to establish a second institution in Glasgow. In the hope of the success of his exertions, no site had been secured for a new Normal Seminary; and when, finally, it was necessary to remove, a site was hastily obtained in the neighbourhood, and there 'long canvas-covered tents, with a sawdust floor, and with rough benches, constituted for a time an admirable collegiate structure.'

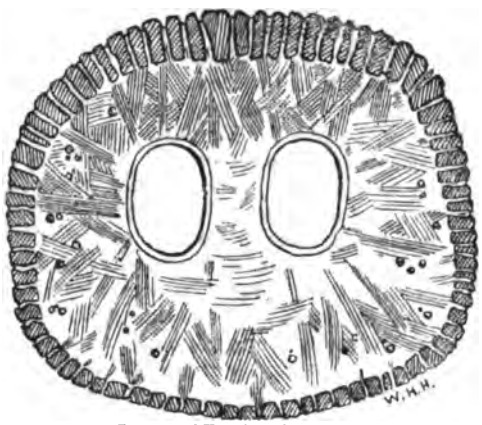
(To be continued.)

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.;
AND THEODORE WOOD,
Joint Author of 'The Field-Naturalist's Handbook.'

No. XIII.—ELEPHANTIANA.

"THE fear of you and the dread of you shall be upon every beast of the earth, and upon every fowl of the air, upon all that moveth upon the earth, and upon all the fishes of the sea; into your hands they are delivered" (Gen. ix. 2).



Section of Trunk of Elephant.

These bold and uncompromising words, written at least four thousand years ago, are absolutely true now, as they were then.

Wild animals, no matter what they may be, instinctively flee from man. The domesticated horse, which has never seen a beast of prey, trembles with terror at the smell of a distant menagerie; but the lion which inspired that terror is, in its wild state, quite as much afraid of the odour of man.

Let a lion but detect the dreaded emanation of man, and he slinks off as quickly as he can.

For, though we are happily unconscious of it, a very powerful odour emanates from all human beings, and strikes terror into wild animals. Deer-stalkers know well that they must approach a stag against the wind, for that even at the distance of a mile the stag can detect the presence of man, should the wind blow from him and not to him.

Similarly, the practical rat-catchers will never touch a trap with bare hands. They wear gloves rubbed with aniseed, and imbue the soles of their boots with the same perfume, before they can venture to handle a trap or to walk near the spot where the trap is set. Inexperienced persons neglect these precautions, and in consequence, the rat detects the dreaded odour of man, and keeps aloof from it.

Mole-catchers, again, always keep the skin of a dead mole by them, and rub it between their hands, before they set their trap, so as to overpower the natural odour of the hand.

Of course, there are some animals, such as lions, tigers, and the like, which will attack and devour human beings. But these are exceptional individuals, being almost invariably the aged animals, which have become too infirm to catch prey in the ordinary fashion, and are reduced to lurking about villages and pouncing upon any unwary straggler.

It is well known that the skin of a "man-eater," whether lion or tiger, is never worth preservation, being mangy, bald in patches, and altogether unsightly. Its skull is equally useless as a specimen, the teeth being blunt, worn down and decayed.

There is no animal, however gigantic, however fierce, however powerful, of which man is not the master. In proportion to his bulk, man is perhaps the weakest of living beings, and yet he is master of the strongest.

Not only can he destroy them—that is comparatively a simple task—but he can take them from their own savage life, and force them to become his servants.

So he has taken possession of the horse, the camel, and the ox, and made them bend their backs to the burden and submit their necks to the yoke.

He has reclaimed the dog from a predaceous life, and taught some of them to guard the flocks which in the wild state they would have devoured, and to be the friends and companions of their masters. Others he has taught to chase prey, not for themselves but for him.

He has taught the falcon to chase birds for him in the air, and the otter and cormorant to catch fish for him in the water. They not only do his work, but are proud of doing it, and contemptuously reject the society of their relatives who live only for themselves.

No better example of the universal mastery of man can be found than in the tame elephant. What is a man, that he should make the mighty elephant obey his orders? The creature could crush him in a moment, and in a fit of blind fury will do so. But when it is in its senses, the elephant acknowledges man as its master, and becomes his obedient servant.

Man rules by two means, Fear and Love. There are some beings which, from no fault of their own, are so constituted that they must be made subject to fear before they can learn to acknowledge Love; and this is the case, not only with different animals, but with different individuals belonging to the same species.

Take, for example, the dog. There are some dogs, just as there are some men, which are constitutionally ill-tempered, violent, ungrateful for kindness, mistaking forbearance for weakness, and ready to bite the hand that feeds them. It is impossible to rule them by love, until they have learned to fear, and can understand that the hand which gives food can withhold it at will, can render them powerless at will, and can at will inflict pain without the possibility of their evading or avenging it.

Having, then, been taught by fear to acknowledge that man is their master, they can begin to learn to be grateful for their food, and to lick the hand which gives, in lieu of biting it. For such dogs a severe chastisement is really the kindest of lessons, and although "force is no remedy," it is often a needful preliminary before applying the remedy.

But there are dogs, as there are men, of a higher order, which are absolutely amenable to Love, but would be only made obstinate and resentful by fear. Such an one was my bull-dog "Apollo." Possessing all the concentrated strength and courage, added to the instinctive combativeness of his race, which make the thoroughbred bull-dog one of the most wonderful animals in the world, he could be compared to nothing but the Faure "accumulator,"

wherein a million foot pounds of force can be carried in one hand. Despite his powers, which none knew better than himself, he was one of the gentlest and most obedient dogs that I have ever dealt with. I had him when he was but a puppy, and never once beat or scolded him. Yet, he would obey the lifting of my finger, or the glance of my eye, and the very idea of incurring my displeasure was unendurable torment to him.

All servants of the pen must of necessity be so absorbed in the evolution of ideas and the balance of sentences, that they are unconscious of time, space, hunger, thirst, cold, or other material conditions.

It has happened that while I have been thus absorbed, Apollo has tried to attract my attention, and in failing, has taken it into his loving brain that he must have offended me in some way. On such occasions he grovelled on the floor, he whined, he licked my hand, and lay in abject despair until again noticed.

So it is with elephants. There are not two elephants with precisely the same disposition, and the best keepers are those who try to find out the peculiar disposition of the creatures under their care, and to treat them in accordance with that disposition.

As elephants, like falcons, are seldom bred in captivity, but are captured when wild, it necessarily follows that the first lesson they must learn is to fear man, and to realize the strange fact that he is their master.

It is a remarkable fact that there is no task which tame elephants undertake so willingly as that of capturing their wild relatives. They seem to enjoy it with all their hearts; and both sexes are equally keen at the sport, the females acting as decoys, and the males as the representatives of force.

Supposing that a male has to be captured, two female "koomkies," as these decoys are called, saunter leisurely along, and soon make the acquaintance of the victim. Each has her keeper, or "mahout," on her back, and it is a curious fact that an elephant never seems to notice a man as long as he is on another elephant's back.

The koomkies manage to place themselves on either side of the male, and by degrees sidle him close to a tree. One of the mahouts then slips quietly to the ground, and while his koomkie and her companion are distracting their victim's attention, he passes strong cords round the animal's ankles, and then makes them fast to a tree. The koomkies will often aid him in this part of the work by taking the ropes in their trunks, and passing them to their master's hand as he wants them.

A similar process is then pursued with the forelegs, and then the treacherous koomkies suddenly slip off, leaving their dupe fast bound to the tree.

Sometimes, before the ropes are firmly tied, the elephant becomes suspicious and tries to escape. The koomkies employ all their blandishments to lull his suspicions; but if he should still resist, and be too strong for them, a powerful male is summoned to their help, and all three beat him and hustle him about until he is quite bewildered, and at last is held firmly against the tree where the mahout is ready with his ropes.

In either case, the duped elephant is left alone, his vast strength paralyzed in some mysterious manner, and his struggles for freedom only resulting in pain. Those who have witnessed these struggles say that the contortions into which a bound elephant will fling its body are almost incredible. It rolls over and over, it rises itself on its hind feet, butts at the tree and tries to knock it down, uttering all the time its screams of mingled terror and anger.

After a while comes another feeling. It can neither eat nor drink, and the pangs of hunger and thirst are felt. At first, it seems to resent the unwonted feeling, but by degrees is so exhausted that it lies motionless on its side.

Now comes its future mahout. Bringing green food in his hand, he cautiously approaches the prostrate elephant. Mostly, rage will for the moment overcome hunger and weakness, and the animal will try to attack the man. In that case, the mahout quietly retires, and leaves the elephant for a few more hours.

This process is repeated until the elephant no longer tries to resist. He has learned his first lesson, that man, small as he may be, is, in some inexplicable manner, stronger than himself, and that resistance is useless.

Now he will take the grass from the mahout, and before long he welcomes the man's presence as the only mode by which he can obtain food. Sooner or later the lesson is learnt, and the captive acknowledges himself in subjection. The koomkies are again summoned, his hind feet are freed from the ropes, though the fore feet are kept hobbled, and, guided by the koomkies, he is taken to his future home, his new master seated on his neck.

As the late Mr. Rarey found to be the case with horses, the subdued elephant entirely trusts in the man who has conquered him, and even conceives a strong affection for his captor.

Sometimes the elephants, instead of being taken singly, are partly enticed and partly driven into a large and very strong enclosure, called a "keddah." This is made of massive posts planted deeply in the ground, and set far enough apart to allow a man to pass easily between them. These are supported on the outside by stout buttresses, so as to withstand the charge of the trapped elephants.

Fortunately, a herd of elephants never unites in a charge on a given spot. If they were to do so it would be scarcely possible to build a keddah which could withstand them. As it is, the posts and buttresses need only be strong enough to resist charges of single elephants.

Once inside the keddah, the elephants are never allowed to rest. By means of fireworks, guns, torches, and shoutings, the elephants are driven backwards and forwards until they are fairly wearied out, and huddle together without even thinking of escape. Then come the hunters, with their koomkies and ropes, and bind the limbs of the wearied animals before they can understand what is happening to them.

Whether the elephant be taken singly or in numbers, the first lesson which it must learn is that it fears man as being stronger than itself, and that therefore it must obey him. Next, it learns to trust to man for food, and is not long before it learns to love him.

But, when, as was the case with the grand African elephant "Jumbo," the creature has lived with man from its infancy, the preliminary lessons are not needed, and man can rule the animal by love without any mixture of fear. On more than one occasion, when Jumbo was disposed to be rather wilful, his keeper, Scott, was urged to use his whip. This he

invariably refused to do, saying, that if he were once to do so, his influence over the animal would be gone.

I fully believe that if I had even once used the whip to Apollo, his absolute belief in me as a being whose displeasure was infinitely worse torture than bodily pain, would have been lost. No creature can defy the extreme of bodily pain more heroically than a thoroughbred bull-dog. Diabolically cruel experiments have been tried on the animal, and a bull-dog has endured the severest tortures without flinching. Pain he would not have feared, but he did fear the loss of my love for him.

Not but that force may not be sometimes necessary with any elephant. However gentle an elephant may be, it is liable to occasional aberrations of temper, which affect it much as a half-grown cat is often affected with fits. The animal loses all control over itself, and for a time is subject to raging madness.

Now, even a cat can do much harm during a fit, and what a terrible creature a mad elephant must be can be well imagined.

The elephant keepers of India, when they perceive symptoms of coming madness, fasten the animal to a tree just as if it had been newly taken. They put it on very low diet, and if it should be very outrageous, they employ their largest and strongest male elephants to assist in coercing it. These animals understand the necessity of restraining their companion, and if other means fail, will beat him with their trunks when he tries to break his bonds.

Only a short time before these lines were written, a remarkable instance of madness in an elephant occurred in Siam.

In that country an albino, or, as it is generally called, a White Elephant, is held to be, not a mere animal, but a material habitation of Divinity, and is honoured accordingly, even the king paying homage to it. The White Elephant is addressed as "Sublime Grandeur." He has his court and household officers like the king. He is lodged in a palace, and is decorated with jewels of priceless value. The "Order of the White Elephant" is in Siam what the Garter is in England, or the Golden Fleece in Spain.

A short time ago, one of these elephants was unexpectedly seized with madness.

He began by trampling to death five of his attendants, and then broke away from all control. As he was a sacred being, he might not be destroyed nor even injured. By direction of the high priest a fence of consecrated bamboos was hastily set up round him, but he made short work of the bamboos, and the high priest himself had a narrow escape of his life.

"His Sublime Grandeur" then fortunately made his way into a court of his palace, where he could be barred in. Just as a cat does during a fit, the elephant dashed himself furiously against the walls, trying to batter them down with his tusks, and at last inflicted such injuries on himself that he fell dead.

Now it would have been much kinder to His Sublime Grandeur if his attendants could have placed him under control during the period of his madness. It would not have lasted for any length of time, and the animal might now have been enjoying the luxuries of his royal home, and the king and court of Siam would not be wearing the garb of woe.

That semi-worship should be offered to an elephant in Siam, may seem absurd enough to us in England. But really, when we recall the history of the great African elephant "Jumbo," I do not think that we can fairly laugh at the Siamese. The strangest part of the Jumbo-worship is, that it sprang up like a mushroom, in a single day.

There were four elephants in the Zoological Gardens, two from Africa, and two from India, the latter having been brought by the Prince of Wales after his tour in India, in 1875-6. Of the two African specimens, the male, named "Jumbo," was obtained by exchange from Paris, and the female, "Alice," was purchased in 1865.

Of all these creatures, the Indian specimens are the most generally interesting, being playful, and so gentle that they are quite pleased when the keeper's children enter their enclosure. Now, Jumbo, though a good-tempered and docile beast enough, had for some time been so uncertain in his temper, that only his keeper, Scott, dared to enter the cage alone.

Temporary madness does not exclusively belong to the male elephant, as is generally supposed. With him, it is almost sure to take place after he has attained adult age.

The Indian magnates are so well aware of this fact that in order to gratify their love of a peculiar department of sport, akin to the bull-fights of Spain, and the badger-drawing, bear-fighting, and dog and cock-fighting, which until lately disgraced our own country, they keep a number of adult male elephants for the purpose of fighting.

Elephants are mild enough except when in the state of "must," as this peculiar condition is called, and when two "must" elephants are placed in proximity to each other, how they fight is admirably told by Dr. W. Knighton in his "Private Life of an Eastern King."

Mr. Davis, the American agent who came to buy Jumbo, mentioned to me that out of the great number of elephants which had been possessed by the firm for which he is acting, some of the most dangerous were females. Few of my readers may be old enough to recollect "Madame Jack," the elephant which took an important part in several plays at the Adelphi Theatre, many years ago. She, like others, went mad, killed her keeper, and, I believe, several men besides, and then had to be destroyed.

Mr. Davis told me that the first sign of the distemper is that the elephants begin to play with something that takes their fancy, and become so excited that they do not obey their keepers. So that for all elephants, male and female alike, the means of restraint ought always to be at hand. We will now return to Jumbo's life in this country.

To naturalists he was of more importance than either of the others, as he was the first example of an African elephant ever known to be imported into England. To myself in particular he was a singularly interesting creature, and I have watched him at intervals since he was no larger than a Shetland pony.

Indeed, so anxious were his owners and keepers, that Professor W. H. Flower, the President of the Zoological Society, stated that he would have consented to Jumbo's removal even if nothing had been paid for him. More than this, Mr. Bartlett, who has had a life-long experience of elephants, was obliged, many months ago, to apply for means of

instantly destroying the animal if he should break out into madness.

As Dr. Sclater, the Secretary, very forcibly remarks of the great establishment possessed by Messrs. Barnum, Bailey, and Hutchinson: "In so large an establishment, any animal under temporary excitement can be withdrawn from exhibition and placed in seclusion, which there are no adequate means of doing in the Zoological Gardens."

Several correspondents stigmatized this "excuse," as they were pleased to call it, as feeble and irrelevant. To my mind, it is simply convincing. Surely it must be kinder to Jumbo to place him among friends who can restrain him during the short and distinct intervals of excitement, and so enable him to enjoy a long life of petted luxury, than to destroy him in the first heyday of youth.

There is a stock argument very much in use by the advocates of total abstinence, to the effect that man is the only animal that will drink intoxicating liquors.

It is a pity that they should employ such an argument, or rather, illustration, for most animals will indulge in stimulants when they can obtain them. In one of Charles Dickens's letters there is an amusing account of a Newfoundland dog that used to go to a public-house every morning, and have his pint of beer "drawed reglar, as if he was a brickmaker."

Wearied horses can be rendered capable of continuing their journey by the administration of a quart of ale. Cows have more than once been known to drink home-brewed ale that had been set outside the farmhouse to cool, and to play the most ludicrous antics in consequence of the indulgence.

The elephant is no exception to the rule, but is a most determined toper whenever he can find an opportunity.

A well-known writer and lecturer on total abstinence lately cited "Jumbo" as a proof that the largest and strongest quadruped in England was a teetotaler. Had he made himself acquainted with the habits of the animal, he would have found that "Jumbo," like all of his kind, is inordinately fond of any alcoholic liquid, preferring whiskey or any other liquor.

The Indian mahouts, when they have to teach their animals any new accomplishment, always reward them with arrack when they succeed, and the promise of a bottle of arrack will always induce an elephant to exert itself to the utmost.

The mode in which the animal drinks a bottle of beer, wine, or spirits is very curious.

The cork is half drawn, and the bottle handed to the elephant. The animal puts the bottle on the ground against a wall or tree trunk, holds it firmly with one of its fore feet, grasps the cork with the finger-like appendage at the end of the proboscis, and twists it out in a moment.

Then it takes the bottle by the mouth, and gradually tilts it up until all the contents have been transferred to the trunk. Then it gives the empty bottle to the keeper, puts the end of its trunk into its mouth, blows the whiskey down its throat, and holds out its trunk for another supply.

A rather ludicrous example of the fondness of the elephant for spirits was lately exhibited by two of Mr. Barnum's elephants.

They had taken cold, and had a fit of the shivers. A gallon or so of whiskey administered to each of them speedily set them right. Next morning they were quite well, but as soon as their keeper came in sight they began to shiver violently, in hopes of obtaining another dose of whiskey.

Some years ago, an elephant, which belonged to a travelling company, was housed for a night in the stable of a hotel. Next morning the elephant was gone, and no one had heard or seen anything of him. That he should have been stolen was not likely, for the thief could make no use of him, and how so huge a beast could have concealed himself was a mystery. The country was scoured in vain all day; but in the evening, a servant, who had occasion to go to the wine-cellar of the hotel, there found the elephant very quietly reposing among the bottles. The animal had evidently been attracted by the scent of the wine, and with the soft, noiseless tread of its kind, had found its way up the great stairs of the hotel, through the hall, and so into the wine-cellar.

Much of the interest excited by Jumbo is due to his enormous size.

We read in many books of travel that elephants are found from twelve to sixteen feet in height, while some writers have even ventured upon twenty feet.

Now an elephant of that height would be so enormous that the tallest giraffe ever known would need almost an additional yard of height in order to look over the elephant's shoulder.

In India, the elephants used for riding are on an average about eight feet in height, and may be compared to men of five feet six inches. Many are little more than six feet high, while an elephant of nine feet is considered a large one, and a nine or ten feet animal is about equivalent to a man of six feet two inches. Any animal that passes ten feet takes rank among giants. Every inch added to the height causes a proportionate increase of bulk, so that when Jumbo stands by the side of one of the Indian elephants, he looks like a dray horse compared to a Shetland pony.

Figures alone give but a poor idea of bulk.

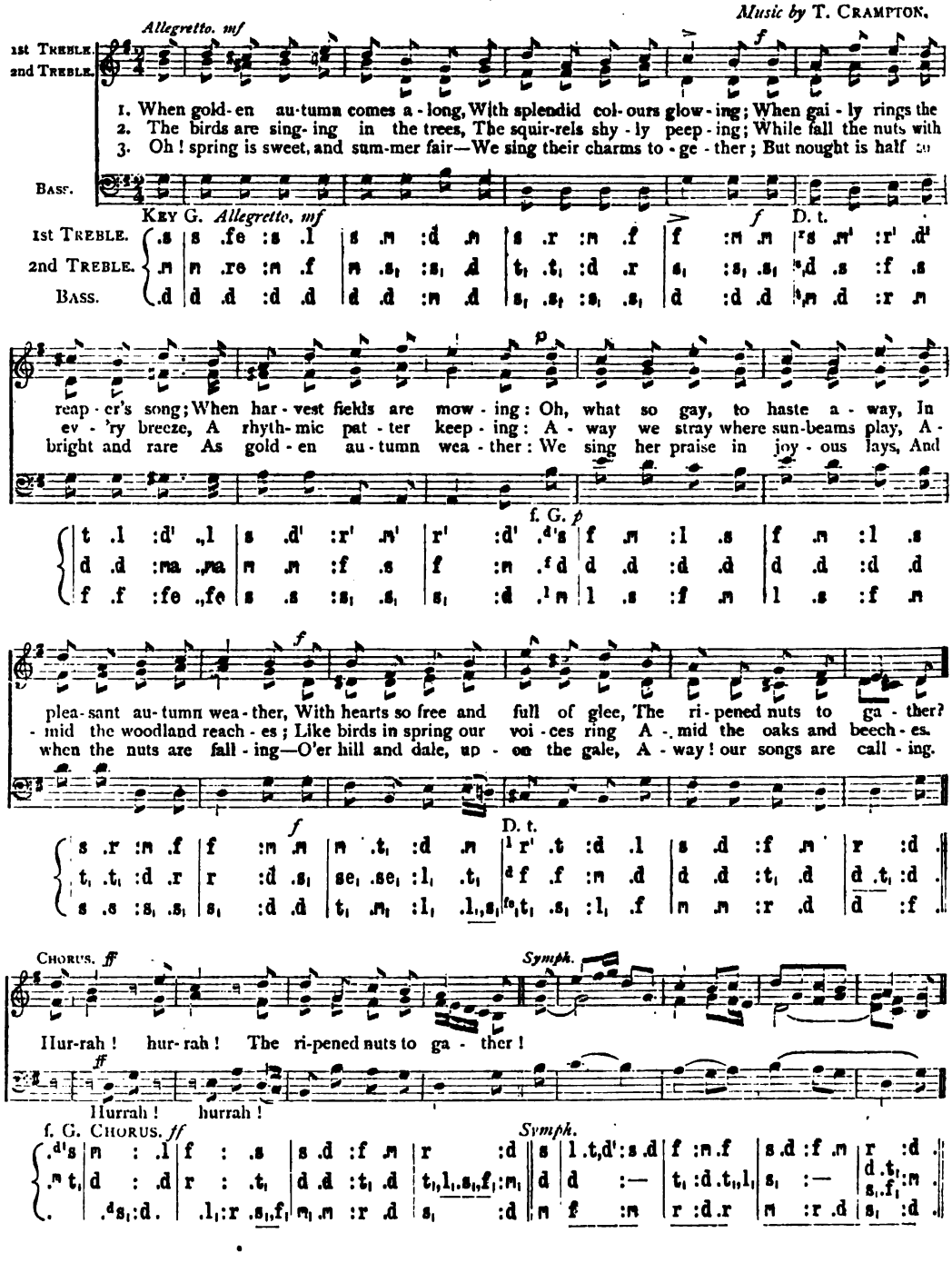
In order to realize the gigantic dimensions of Jumbo, measure eleven feet in height on the side of a room, and then measure fourteen feet lengthwise; then picture to yourself an elephant of that height and length, and you will form some idea of the proportions of Jumbo. Perhaps even those proportions may be exceeded in time. He is yet but a lad, according to the duration of elephant life, and if he were to attain another six or seven inches in height, and gain another ton in weight, I should not be surprised.

For years Jumbo was an inmate of the Zoological Gardens, growing rapidly, and in course of time helping the keeper to amuse the younger visitors by carrying them on his back. Even their elders did not disdain a ride on so vast an animal, as I can vouch from personal experience. Still, except for his size, Jumbo created no particular interest, and the public cared no more for him than for the other elephants.

Then a report was bruited abroad that an American agent was negotiating for the purchase of Jumbo, and the public naturally thought that the Zoological Society would do itself harm by parting with the largest elephant that had ever been known in Europe.

(*To be continued.*)

NUTTING SONG.

Music by T. CRAMPTON.

Allegretto. mf
1st TREBLE.
2nd TREBLE.
BASS.
1. When gold-en au-tumn comes a-long, With splendid col-ours glow-ing; When gai-ly rings the
2. The birds are sing-ing in the trees, The squir-rels shy-ly peep-ing; While fall the nuts with
3. Oh! spring is sweet, and sum-mer fair—We sing their charms to-ge-ther; But nought is half so
KEY G. Allegretto. mf
D. t.
reap-er's song; When har-vest fields are mow-ing: Oh, what so gay, to haste a-way, In
ev-'ry breeze, A rhyth-mic pat-ter keep-ing: A-way we stray where sun-beams play, A-
bright and rare As gold-en au-tumn wea-ther: We sing her praise in joy-ous lays, And
f. G.
plea-sant au-tumn wea-ther, With hearts so free and full of glee, The ri-pened nuts to ga-ther?
-mid the woodland reach-es; Like birds in spring our voi-ces ring A-mid the oaks and beech-es.
when the nuts are fall-ing—O'er hill and dale, up-on the gale, A-way! our songs are call-ing.
CHORUS. ff
Symph.
Hur-rah! hur-rah! The ri-pened nuts to ga-ther!
Hurrah! hurrah!
f. G. CHORUS. ff
Symph.

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

Boys' School.

685
79
450
806
43
Ans. 2063

457
391
Ans. 66

567
98
Ans. 469

6080907
6
Ans. 36485442

Infants' School.

386
97
Ans. 289

385
291
Ans. 94

801040709
4
Ans. 3204162836

308
26
480
933
706
4
Ans. 2457

Bind, Fire, Coal, Fender, Poker, Tongs, Bright.

Sleeping, Window, Nest, Strong, Wings, Hail, Morning.

STANDARD II. (BOYS).

A.

13804
12686
Ans. 1118

29608
269
Ans. 7964552

8 | 35769
Ans. 4471—1

6090
14800
10010
6008
Ans. 36908

B.

13804
9081
Ans. 4723

29608
468
Ans. 13856544

9 | 35769
Ans. 3974—3

6090
14800
10010
6080
687
Ans. 37667

A. and B.—In a school there are 127 boys and 89 girls. How many boys and girls altogether will there be in 6 such schools? Ans. 1296.

Dictation.—In a few minutes the engine will come puffing along, and the carriages will stop by the side of the platform. When the train arrives no time is lost. Some passengers get out and some get in.

STANDARD III. (BOYS).

(1) I bought a suit of clothes for £3 10s., hat 7s. 6d., boots 15s. 6d., scarf 3s. 6d., and had 4s. 6d. left. How much had I at first? Ans. £5 1s.

(2) Divide one hundred and thirty-three thousand and fifty-six by one hundred and thirty-six.
Ans. 978—48.

(3) I have 13 baskets of oranges, each basket containing 14 oranges. How many are left after I sell 12 dozen? Ans. 38.

(4) Take one thousand and sixty-seven pounds seventeen shillings and fourpence farthing from thirteen thousand one hundred and seventy pounds ten shillings and eightpence.
Ans. £12,102 13s. 3¾d.

(5) Add nine shillings and sixpence, twenty-five pounds ten shillings and sixpence, seven thousand and eight pounds thirteen shillings and three farthings, ninety thousand and nine pounds four shillings and a penny halfpenny, seven hundred and ten pounds sixteen shillings and ninepence farthing, and three thousand and seventy pounds fifteen shillings and elevenpence three farthings.
Ans. £100,825 9s. 11¼d.

STANDARD IV. (BOYS).

(1) Divide nine thousand five hundred and fifteen pounds two shillings and ninepence by three hundred and eighteen. Ans. £29 18s. 5$\frac{9}{4}$d.—300.

(2) How many grains are there in 3 lbs. 10 dwts. of gold? Ans. 17,520.

(3) Find the worth of 1000 square yds. of land at 3s. 3¾d. per yd. Ans. £165 12s. 6d.

(4) A train takes 4 minutes exactly to go through a tunnel 2½ miles long. How many feet is that in a minute? Ans. 3300.

(5) Take nineteen thousand and ninety from one hundred thousand nine hundred, and multiply the remainder by one thousand and ten.
Ans. 82,628,100.

STANDARD V. (BOYS).

(1) Find by practice cost of 2 cwt. 1 qr. 21 lbs. at 1s. 11d. per lb. Ans. £26 3s. 3d.

(2) How far would 1 ton 12 cwt. be carried for £20, if 2 tons 12 cwt. are carried 102 miles for the same money? Ans. 165¾ miles.

(3) A miller has working for him 15 men and 13 boys. Their wages, men and boys, amount to £25 1s. How much does a boy get, if a man gets £1 9s. 6d.? Ans. 4s. 6d.

(4) If a town clock loses 1 minute 45 seconds in 43 weeks 4 days, how much will it lose in a leap year? Ans. 2 minutes 6 seconds.

(5) Bill:—
300 buns at 3 a penny.
1½ lb. seed loaf at 7½d. per lb.
3 cwt. plain bread at 1¼d. per lb.
120 lbs. bread at 2½d. per lb.
7 doz. sponge buns at 3¼d. each.
Ans. £4 12s. 0¼d.

STANDARD VI. (BOYS).

(1) A man saves £50 a year out of his income of £282 10s. How much will he spend in 298 days?
Ans. £189 16s. $5\frac{12}{73}$d.

(2) If 50 quires of paper weigh 1·06125 lbs., how many quires are there in ·05 tons? Ans. 5276·796+

(3) Reduce $\frac{18}{25}$ and $\frac{3}{20}$ to decimals, and subtract the least from the greatest. Ans. ·006.

(4) If it takes 3 million bricks to build a viaduct, each brick weighing $6\frac{3}{8}$ lbs., what will be its total cost at $£6\frac{1}{5}$ per ton? Ans. £55059 10s. $5\frac{1}{7}$d.

(5) Find the difference between $\frac{2}{3}$ of $1\frac{1}{8}$, and the ninth part of a dozen. Ans. $\frac{5}{9}$.

Domestic Economy.

(1) Write all you know about ventilation.

(2) What rules should be observed in purchasing furniture for a small house?

(3) How would you clean—
(1) Articles of brass.
(2) Vessels used for holding milk.

Grammar and Parsing.

Parse

(A) I come from haunts of coot and hern,
I make a sudden sally;

(B) I sparkle out amongst the fern,
I hurry down the valley.

STANDARD VI.

Write an essay on one of the following subjects:—

(1) What do you intend to do when you leave school?
(2) Canada.
(3) The railway.

Geography.

(1) What are the motions of the earth?

(2) Where is the Torrid Zone? In what zone do we live?

(3) What is a cape? Name some capes?

(4) What is a mountain? A hill?

(5) What is land lying between two hills?

STANDARDS IV., V. AND VI.

(1) Chief towns of Ireland and Scotland?

(2) Forths and Bays of Scotland?

(3) What is the chief occupation of the people of Lewis?

(4) In what colony is Adelaide?

(5) What are the natives of New Zealand called?

(6) Name mountains of New Zealand.

(7) Any islands in Pacific belonging to Britain?

(8) To what group of islands does Jamaica belong?

Scholarship Examination, 1882.

QUESTIONS WITH ANSWERS.

AT the beginning of the Examination a notice was issued as in former years to all the candidates respecting copying and clandestine assistance.

The following was placed at the head of each paper:—Before beginning your answers, fill up the following table.

You will do this although you may not answer any part of the paper, which in that case you will return to the Inspector, writing the words 'not attempted' in large letters below.

The name of the Institution at which you are now being examined.	Your Name IN FULL (the *Surname* first), and your Age on your last birthday.	Do you attend this Examination as— 1. A Candidate for admission to a Training College? 2. A Candidate for the office of Assistant Teacher? State the name of the School in which you were a Pupil Teacher. If you have not been a Pupil Teacher, state so.

Dictation and Penmanship.

Twenty minutes allowed for these Exercises.

Candidates are not to *paint* their letters in the *Copy-Setting Exercise*, but to take care that the copy is clean and without erasures.

Omissions and erasures in the *Dictation Exercise* will be counted as mistakes.

The words must not be divided between two lines; there is plenty of room for the passage to be written.

Write in large hand, as a specimen of penmanship, the words, *Major Fitzgerald.*

Write in small hand, as a specimen of penmanship, the sentence—

There is a willow grows aslant a brook
That shows his hoar leaves in the glassy stream.

Dictation.

Write the passage dictated to you by the Examiner, and punctuate it correctly.

[*A.* and *B.* were alternate passages.]

A.

They paddled onward hour after hour, sheltering themselves as best they could under the shadow of the southern bank; while on their right hand the full sun-glare lay upon the enormous wall of figs and laurels which formed the northern forest, broken by the slender shafts of bamboo tufts, and decked with a thousand gaudy parasites; bank upon bank of gorgeous bloom piled upward to the sky, till where its outline cut the blue flowers and leaves, too lofty to be distinguished by the eye, formed a broken rainbow of all hues quivering in the ascending streams of azure mist, until they seemed to melt and mingle with the very heavens.

B.

As the sun rose higher and higher, a great stillness fell upon the forest. The jaguars and the monkeys had hidden themselves in the darkest depths of the wood; the very butterflies ceased their flitting over the tree-tops, and slept with outspread wings upon the glossy leaves, undistinguishable from the flowers around them. Now and then a parrot swung and screamed at them from an overhanging bough; or a thirsty monkey slid lazily to the surface of the stream, dipped up the water in his tiny hand, and started chattering back, as his eyes met those of some foul alligator, peering upward through the clear depths below.

Composition.

Write a letter on *one* of the following subjects:—(1), Gardening; (2), A storm at sea; (3), A day's angling; (4), Some public park.

(1)

Lesbury,
Northumberland,
July 8th, 1882.

MY DEAR PROCTOR,—I have been spending a few weeks here with a relative. Far away from the bustle of the town, it seemed as if I should be utterly cut off from the usual enjoyments of life. Such was the case, but it meant only the substitution of other, though less exciting, pleasures, and among these not the least pleasant were some elementary lessons in gardening. Lesbury is admirably situated for carrying on this work. It stands on the southern slope of a gentle range of hills, which serve to protect it from the piercing winds of the N.E. coast. It is well wooded and watered, the soil is deep and loamy; and this combination of circumstances renders it eminently suitable for gardening purposes. Here are gardens of every size, from a square plot at the front of a labourer's cottage to large market gardens covering many acres.

This is the season when most of the hard work of the year is over. The gardener is now reaping the fruit of his toil in the earlier months of the year. *Then* he had the soil to turn over, the weeds to get rid of, and the plants and bushes to trim and supply with the necessary manure. As each month came, and the frosts disappeared, the seeds had to be sown, and care taken to protect the more tender shoots from the chilly night air. *Now* everything is bright and cheerful. The plots devoted to flowers are gay with roses, violets, geraniums, marigolds, daisies, and other flowers. The vegetables are covering the ground in rich profusion, while the bushes are laden with berries, and the trees give promise of a rich burden of fruit. Strawberries, currants, and gooseberries are being gathered, and as there has been little rain, water is being supplied to the thirsty flowers.

I have never seen such a wealth of fruit, and as for the odours they are as delicious as those of Araby.

The refining influence exerted by constant contact with delicate flowers is everywhere apparent, and this is certainly not the least of the benefits which a plot of ground used for this purpose confers on its possessor.

I shall heartily regret leaving the village, but more that in the crowded city I shall be unable to participate in this enjoyment, which has been at once new and delightful to me.

With kind regards, I am,
Ever yours truly,
JAMES DOUGLAS.

(2)

Bamborough,
July 9th, 1882.

MY DEAR BROTHER,—We have often spoken to each other of the different emotions caused by a view of the sea, but when I last saw you neither of us had experienced the feelings engendered by being in a storm at sea.

Since then, however, I have added to my former experience, and I know now how terrible a foe it can be. We were sailing across the North Sea from Hamburg to Berwick. The day was close and stifling, and gradually great black clouds spread themselves over the sky. Everything about us seemed to presage a storm. Sudden gusts of wind passed across the ship's track, and orders were given to prepare for the approaching gale. The sea, hitherto smooth as glass, was soon covered with a strong lipper, and as the wind strengthened the motion of the ship became more and more uneven, and we had difficulty in moving about comfortably on the deck. Every moment seemed to increase the fury of the blast, and a pitiless storm broke over us.

The wind and the waves together seemed like storm fiends let loose to hurry us to destruction. One instant we seemed as if plunging headlong to the bottom, the waves breaking over the sides of the ship in great sheets, and the next it seemed as if the bow of the ship were about to pierce the clouds. The united strength of two men was required at the helm, and the captain and the man on the look-out peered into the gloom to catch sight of the lights which were to warn them off the rocks on this dangerous coast.

Notwithstanding all the efforts of the helmsmen, we had been driven southward, and the prospects of safely reaching the harbour became more and more gloomy. The roar of the wind among the sails and shrouds was deafening, and the waves, fearful of losing their prey, dashed over us and broke in fragments round about us in their baffled anger.

One of the happiest moments of our lives was when we heard that Longstone was in sight. With great skill the captain kept us from the strong currents running near the Farne Islands, and ere long we reached the harbour in safety. We were indeed grateful to every one who had contributed to the safety of the ship, and thoroughly glad to be once more on shore.

Had great skill not been displayed, you would not now have been receiving this

From your affectionate brother,
THOMAS WAKE.

(3)

Dunkeld, Perthshire,
July 10th, 1882.

DEAR BEN,—'Come and spend a week with me and have a day at the gentle craft,' was the burden of an invitation I had from a fellow-teacher a short time ago. The prospect of a day on the banks of the Tay could not be resisted, and I gladly accepted the invitation. The great beauty of the neighbourhood was in itself sufficient attraction, but when the day for fishing dawned I looked anxiously forth lest wind and weather should spoil our sport.

I remembered the old couplets:—

'When the wind blows from the north
Then the angler goes not forth;
When the wind blows from the east
Then the fishes bite the least.'

From neither quarter were we troubled. There was just a sufficiently strong west wind to ruffle the surface of the stream, and the sky was just as much overcast as to make it pleasant, and prevent strong shadows.

Provided with all needful apparatus we soon reached the river, and for a time were content to follow old Izaak Walton's recommendation, and fished diligently up the stream. By-and-by we grew a little weary of this, and sought out the most likely places, now and again throwing the line where the waters broke over a stone, a sure hiding-place for a trout, or again where the stream swept under the overhanging boughs of a tree, or into an eddying bay.

By this means we succeeded in increasing the weight of our creels; but after luncheon we determined to crown the fortunes of the day by trying for higher game, and adding a lusty salmon to our store. It was not long before success attended my efforts. A sudden tug at my line sufficiently strong to stretch it to its utmost tension, and almost bend the rod double, told me that the bait had taken and the fish had darted away. I followed as best I could, giving the fish as much play as I could. Hope and fear alternated strangely in my breast—hope that I might land my prize, and fear lest my line should give way. Ever and anon I was wading deep in the river, then on the bank, now fast, now slow, the fish playing ten thousand pranks, till, gradually tiring him out, with a dexterous throw I landed him on the bank, a pleasing result of an arduous struggle.

I wish you had been with me to enjoy the sport, hoping that such another day is not far distant.

I am, yours very truly,
W. H. DENTON.

(4)

Gateshead,
July 10th, 1882.

MY DEAR SYRINA,—I do not think I have ever told you of the beautiful park in our town. You who live in London associate the district with nothing but coals and smoke, and chemical fumes, but I can assure you we have some spots of rare beauty here. Our park is one of them.

It is situated on the outskirts of the town, on the side of one the loveliest valleys in the northern counties. Below it runs the river Team, and on the opposite side of the valley stretch the extensive woods of Ravensworth Castle, belonging to the noble earl of that name. Opening up to the north-west is the broad valley of the Tyne, whose waters sparkle like a sea of gold in the rays of the setting sun.

Everything that art can do has been done to enhance the natural beauties of the place. A dene, with sides covered with huge trees, and through which runs a small stream, affords a cool retreat on the hottest of days, while scores of seats are temptingly placed under the spreading boughs of trees, and afford abundant facilities for quietly enjoying the scene.

A large lake in which disport numerous waterfowl, and whose surface is often covered with fleets of tiny craft; an aviary, stocked with rare and beautiful birds; a monkey-house whose inhabitants are a constant source of amusement to children of all ages; a bowling green, and a playground for children, are among the other attractions of the park.

A more beautiful place I do not think you could desire, and I do hope you will spend your holidays with me this year, and you

will then be able to judge for yourself. Several nights in the week we have capital music from our own local bands, and if you will come I know you will alter your erroneous opinions of this neighbourhood.

Do try and come. With best wishes for all my London friends and yourself,

Believe me, ever your loving friend,

A. W. MYERS.

Grammar.

Two hours and a half allowed for this paper.

(No abbreviation of less than three letters to be used in parsing or analysis.)

All candidates must do the composition, parsing, and analysis, and must not answer more than five other questions.

1. Parse fully the words italicised in the following sentences (Syntax is an essential part of parsing):—

'For *who would bear*
The insolence of office and the spurns
That patient merit of the *unworthy* takes,
But that the dread of *something* after death,
The undiscovered country from whose bourn
No traveller returns, *puzzles* the will,
And makes us *rather* bear those ills we have
Than fly to others that we know not of?'

Who—pronoun, interrog., com., 3rd, sing. or plural, nom to 'would bear.'
would—Aux. verb to 'bear,' indicating pot. mood, past.
bear—Verb, irreg. trans., act., inf., pres., gov. by 'would.'
would bear—Verb, irreg. trans., act., pot., past, 3rd, sing. or plural, agreeing with its nom., 'who.'
unworthy—Adj. used as a noun, com., plural, 3rd, obj., gov. by 'of.'
but—Conj. disj., joining the sents. 'Who would bear' and 'It may be,' understood.
that—Conj. cop., joining the sents. 'It may be' and 'The dread puzzles.'
but that—Sometimes parsed as compound conj., joining the sents. 'Who would bear' and 'The dread puzzles.'
something—Com. noun, neuter, sing., 3rd, obj., gov. by 'of.'
puzzles—Verb, reg. trans., act., ind., pres., 3rd, sing., agreeing with its nom. 'dread.'
rather—Adv. of degree, modifying 'puzzles.'
than—Conj. cop., correlative with the adverb rather, and joining the sents. 'It makes us bear' and 'It makes us fly.'
fly—Verb, irreg. intrans., act., inf., pres., gov. by 'makes.'
others—Com. noun, neuter, plural, 3rd, obj., gov. by 'to.'
that—Rel. pronoun, neuter, plural, 3rd, agreeing with antecedent 'others,' obj. gov. by 'of.'

2. Analyse the sentence in Ques. 1, making a table, so as to show in separate columns:—

(1) The nature of the sentence.
(2) (If dependent) its relation to the principal sentence.
(3) Subject.
(4) Its enlargement (if any.)
(5) Predicate.
(6) Its extensions (if any)
(7) Object.
(8) Its enlargements (if any.)

Kind of Sentence.	Relation to Principal Sentence.	Subject.	Enlargement of Subject.	Predicate.	Extension of Predicate.	Object.	Enlargement of Object.
(*a*) Principal Sent., causative, co-ordinate to preceding Sentence.		[For] who		would bear		insolence	the of office
(*b*) Principal Sent.	Co-ord. to *a*, contracted in subject and predicate.	[and] (who)		[would bear]		spurns	the
(*c*) Subordinate Sent.	Adjective to *spurns* in *b*.	merit	patient	takes		that (dir. obj.) of the unworthy (ind. obj.)	
(*d*) Subordinate Sent.	Advl. to *a*.	[But that] dread	the of something after death, the undiscovered country.	puzzles		will	the
(*e*) Subordinate Sent.	Advl. to *a*, and co-ord. with *d*.	[and] (the dr. ad)		makes	rather (manner)	us (dir.) to bear those ills (indir.)	
(*f*) Subordinate Sent.	Adj. to *ills* in *e*.	we		have			
(*g*) Subordinate Sent.	Advl. (manner) to *e*. contracted in pred.	than (the dread)		(makes)		us (dir.) to fly to others (indir.)	
(*h*) Subordinate Sent.	Adj. to *others* in *g*.	we	know	not		of that (indir.)	

3. Select and classify the pronouns, conjunctions, and prepositions in the same sentence.

Pronouns—*Who, that, whose, that*, are relative pronouns.
Us and *we* are personal pronouns.
Conjunctions—*For, and, and*, copulative or co-ordinate.
But, that, disjunctive or sub-ordinate.
Than, correlative.
Prepositions—of, showing a relationship denoting *possession*.
of ,, ,, ,, *place*.
of ,, ,, ,, *possession*.
after ,, ,, ,, *time*.
from ,, ,, ,, *place*.
to ,, ,, ,, *place*.
of ,, ,, ,, *possession*.

4. Explain the terms cardinal, ordinal, and indefinite numerals, and give examples of each.

Cardinal numerals are such adjectives as denote *how many*, as *five, nine, seventy*, etc.
Ordinal numerals are such adjectives as denote the order in which objects are placed, as first, second, third, tenth, etc.
Indefinite numerals are those adjectives which do not denote an exact number, as some, few, many, several, etc.

5. Give the past tenses of the verbs crow, hew, sing, win, help, bid, chide, write, dig, lie, get, shear, and any obsolete forms of those tenses.

Present.	*Past.*	*Obsolete forms.*
crow	crowed, crew	
hew	hewed	
sing	sang	
win	won	wan
help	helped	holp

Present.	*Past.*	*Obsolete forms.*
bid	bade, bid	
chide	chided or chid	chode
write	wrote	writ
dig	dug, digged	
lie (to rest)	lay	
lie (to speak untruth)	lied	
get	got	gat
shear	sheared	shore

6. Classify the English conjunctions, and show that they are frequently derived from verbs.

Conjunctions are differently classified by different grammarians. One classification is into:—

(*a*) *Copulative*, those which join sentences and also unite their meaning.

and (*b*) *Disjunctive*, those which join sentences, but disconnect their meaning.

Another classification is into:—

(*a*) *Co-ordinative*, those which join together two principal sentences.

and (*b*) *Sub-ordinative*, those which connect sub-ordinate sentences to principal sentences.

The following are conjunctions derived from verbs:—Albeit, howbeit, except, notwithstanding, seeing, save, provided.

7. Explain the force of the following affixes: -dom, as in martyrdom; -some, as in handsome; -less, as in speechless; -ible, as in flexible; and give other examples of each affix.

-dom, in martyrdom, signifies the state or condition implied in the word martyr: kingdom, freedom, wisdom, earldom.

-some, in handsome, originally signified what came readily to the hand, hence, generous, ample, full, liberal, (*e.g.*, He gave a handsome donation). Words ending in -some indicate a good deal of the quality denoted by the noun—troublesome, burdensome, wearisome.

-less, without. Heedless, sinless, witless, senseless, thriftless, houseless.

-ible, in flexible, that which may be (*flecto*, I bend). Irrepressible, indestructible, comprehensible.

8. Define a preposition, and show that prepositions do not always precede the noun they govern.

A preposition is a word placed before a noun or pronoun to show the relation which it bears to some other word in the sentence denoting either a thing, action, or attribute.

In the formation of sentences sometimes the preposition comes after the word it governs, *e.g.*:—

This is the castle which I told you of.
What have you called for?
He whom we saw is not a pleasant man to travel with.
Such work I cannot put up with.
What game have you been playing at?

Here *of* governs *which*, *for* governs *what*, *saw* governs *whom*, *with* governs *work*, and *at* governs *game*.

8. Give examples of noun, adjective, and adverbial clauses employed in subordinate sentences.

Noun clauses: (1) I know *that he will come* (obj. of know).
(2) It is true *that he has arrived* (in apposition with *it*).
(3) *That he was killed* is certain (subj. of *is*).

Adjective clauses: (1) The man *who called* was the gardener (qualifying the subject).
(2) He carried the box *which I had bought* (qualifying the object).
(3) That is the school *where I was taught* (where = in which).

Adverbial clauses: (1) He called *while I was out* (time qual. *called*).
(2) It ended *as it had begun* (manner qual. *ended*).
(3) We love Him *because He first loved us* (cause qual. *love*).

Each of the above clauses forms a part of the principal sentence, but is itself a sentence having a subject and predicate.

9. Name the sources of our language from which the following words are derived:—

Hat, shoe, vest, glove, sock, bonnet, ribbon, tunic, and shirt.
hat—Danish *hat*; in Anglo-Saxon *haet*.
shoe—A.S. *sceo*; in German *shuh*.
vest—Latin *vestis*.
glove—A.S. *glof*.
sock—A.S. *socc*, or Latin *soccus*.
bonnet—Gaelic or Celtic *bonaid*.
ribbon—French *ruban*.
tunic—Latin *tunica*.
shirt—A.S. *sceort*, probably from Latin *curtus*, short.

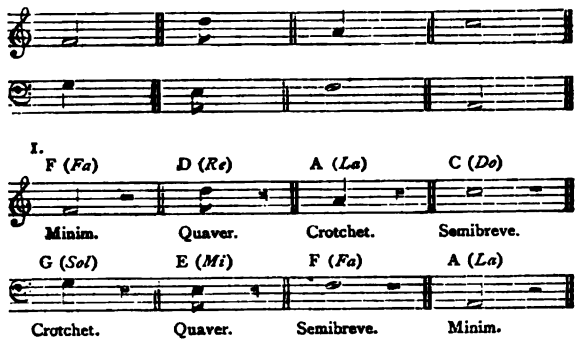
Music.

Three hours allowed for this and the School-Management paper.

The Tonic Sol-fa questions are printed in italics.

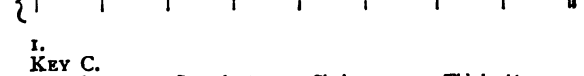
Candidates must keep *entirely* to one set of questions or the other. *They are not permitted to answer more than* FOUR *questions.*

1. Write *over* each of the following notes its pitch name (A, B, *Do*, *Re*, or other), *under* it its duration name (crotchet, quaver, or other), and *after* it its corresponding rest.

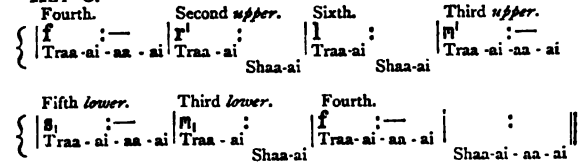


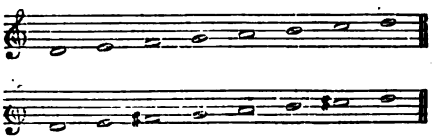
1. *Write* over *each of the following notes its name with regard to its position in the scale* (*third, fifth, or other*), *and* under *each the time names for notes and rests.*

KEY C.



I.
KEY C.

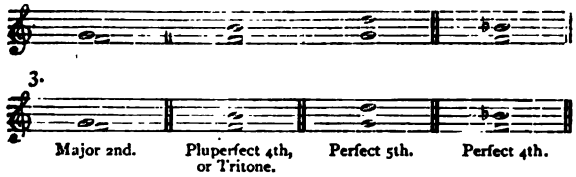


2. Complete the following as a scale of D (*Re*).

2. Write a scale in the *Lah* Mode, and one in the *Ray* Mode.

2. Ancient Lah Mode. l t d r m f s l
Modern Lah Mode. l t d r m ba se l
Ray Mode. r m f s l t d r

Ancient Lah.	or, Modern Lah.	Ray.
l	l	r
	se	
s		d
	ba	t
f		
m	m	l
r	r	s
d	d	f
t	t	m
l	l	r

3. Write under each of the following pairs of notes its name (second, third, or other) and quality (major, perfect, or other).



3.

Major 2nd. | Pluperfect 4th, or Tritone. | Perfect 5th. | Perfect 4th.

3. *Write under each of the following pairs of notes its name (second, third, or other), and quality (major, perfect, or other).*

KEY C.

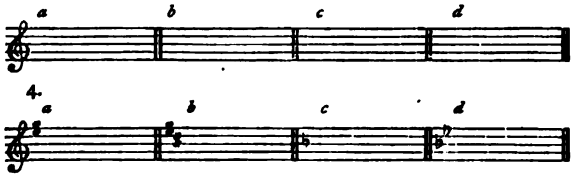
s :	t :	r' :	ta :
f :	f :	s :	f :

3.

KEY C.

s :	t :	r' :	ta :
f :	f :	s :	f :
Major 2nd.	Pluperfect 4th.	Perfect 5th.	Perfect 4th.

4. Write in *a* the signature of G (*Sol*), in *b* that of D (*Re*), in *c* that of F (*Fa*), and in *d* that of B♭ (*Se*).



4.

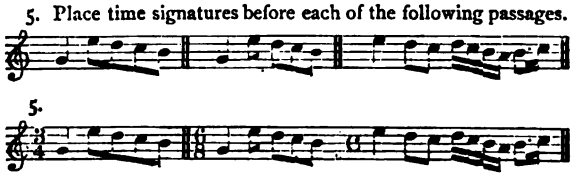
4. *Write the names of the respective Dohs when Lah is B, D, and E, and the names of the Lahs in Keys D, F, and B♭.*

4.

Lah B	Doh D
,, D	,, F
,, E	,, G

Key D	Lah is B
,, F	,, D
,, B♭	,, G

5. Place time signatures before each of the following passages.



5.

5. *Write a phrase in three-pulse measure in primary form, and a phrase in six-pulse measure.*

5.

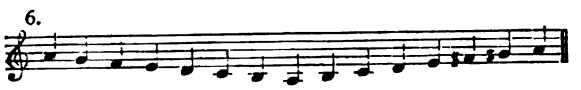
KEY D. Three-pulse measure.

d	:m	:s	m	:d	:r	d	:—	:—

KEY F. Six-pulse measure.

:d	m	:r	:d	m	:r	:d	s	:-	:s	d	:-

6. Write the scale of A (*La*) minor, descending and ascending.

6.

6. *Write the upper part of the scale in the minor mode, ascending or descending, in all the ways with which you are acquainted.*

6.

Ascending. Old Lah.	Ascending. Modern.		Descending.
l	l	l	l
	se	se	
s	(s)	(s)	s
	ba		
f		f	f
m	m	m	m

ANSWERS TO
Pupil Teachers' Examination Papers.
AUGUST 26TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the cost of 165½ cwts. at £2 5s. 6d. per cwt.

	£	s.	d.
Cost of 165½ cwts. at £2 each =	331	15	0
,, ,, ,, 5s. ,, = ½ cost at £2 =	41	9	4½
,, ,, ,, 6d. ,, = 1/10 ,, 5s. =	4	2	11½
	£377	7	3½ Ans.

2. What is the price of 51,143 articles at £4 17s. 9½d. each?

	£	s.	d.
Price of 51,143 at £4 each =	204572	0	0
,, ,, 16s. = ½ price at £4 =	40914	8	0
,, ,, 1s. 4d. = 1/12 ,, 16s. =	3409	10	8
,, ,, 4d. = ¼ ,, 1s. 4d. =	852	7	8
,, ,, 1d. = ¼ ,, 4d. =	213	1	11
,, ,, ½d. = ½ ,, 1d. =	53	5	5½
	£250014	13	8½ Ans.

3. If 287 is the first term of a proportion, 372 the second, and 5376 the fourth, what is the third? Explain the reason of the rule you employ.

287 : 372 :: ? : 5376

If four terms are in proportion the product of the extremes is equal to the product of the means—that is, taking the above as an example, 287 × 5376 equals 372 multiplied by the third term, ∴ $\frac{287 \times 5376}{372}$ will give the term required, viz., 4147 1/31. Ans.

4. If a man earns £17 6s. in 102½ days, in what time will he earn 50 guineas?

£17 6s. : £52 10s. :: 102½ days : ?

or 346s. or 1050s.

$$\frac{205 \text{ days} \times 1050}{2 \times 346} = 311\frac{19}{173} \text{ days. Ans.}$$

FEMALES.

1. Make out the following bill:—

27 yards of black cloth at 23s. 7d. per yard.
34 yards of blue cloth at 19s. 8d. per yard.
23 yards of olive cloth at 16s. 4d. per yard.
29 yards of cassimere, black, at 9s. 11d. per yard.
31½ yards of cassimere, drab, at 7s. 6d. per yard.
40¾ yards of cassimere, mixed, at 6s. 4d. per yard.

	s.	d.		£	s.	d.
27 yards at	23	7	per yard =	31	16	9
34 ,,	19	8	,, =	33	8	8
23 ,,	16	4	,, =	18	15	8
29 ,,	9	11	,, =	14	7	7
31½ ,,	7	6	,, =	11	16	3
40¾ ,,	6	4	,, =	12	15	8½
				£123	0	7½ Ans.

2. Find the cost of 748 articles at £109 15s. 0¼d. each.

	£	s.	d.
Value of 748 articles at £1 each =	748	0	0
			109
,, ,, ,, £109 ,, =	81532	0	0
,, ,, ,, 10s. = ½ at £1 =	374	0	0
,, ,, ,, 4s. = ⅖ ,, =	149	12	0
,, ,, ,, 1s. = ¼ at 4s. =	37	8	0
,, ,, ,, ¾d. = 1/16 at 1s. =	2	6	9
	£82095	6	9 Ans.

3. What is the value of 48 sq. yds 5 sq. ft. 54 sq. in. at fourteen shillings and eightpence per sq. yd. ?

	£	s.	d.
Value of 1 sq. yd.	= 0	14	8
			48
,, 48 ,,	= 35	4	0
,, 4½ sq. ft. = ⅑ price of 1 sq. yd.	= 0	7	4
,, 108 sq. in. = ⅓ ,, 4½ ft.	= 0	1	2⅔
,, 18 ,, = ⅙ ,, 108 in.	= 0	0	2⅔
	£35	12	9½ Ans.

4. Divide £9 11s. 8d. among ten men, six women, and fourteen children, giving a woman three times as much as a child, and a man twice as much as a woman.

14 children get 1 share each = 14 shares
6 women ,, 3 shares ,, = 18 ,,
10 men ,, 6 ,, ,, = 60 ,,
Total 92

	s.	d.	
£9 11s. 8d. ÷ 92 =	2	1	child's share. Ans.
2s. 1d. × 3 =	6	3	woman's ,, Ans.
6s. 3d. × 2 =	12	6	man's ,, Ans.

Grammar.

1. Point out and parse all the verbs and adjectives in the following passage:—Then was King Alfred glad at heart, and he was strong and very courageous; for he knew that he would overcome his enemies by the help of God. So in the morning he arose, and sailing to the land he blew his horn three times, and his friends, hearing it, rejoiced, and his enemies, hearing it, feared greatly.

was—irreg. intrans. verb, *am, was, been*, indic., past, indef., 3rd pers., sing., agr. with '*King Alfred*.'
glad—predic. adj., qual. '*King Alfred*.'
was—same as above, agr. with '*he*.'
strong—predic. adj., qual. '*he*.'
courageous— ,, ,, ,,
knew—irreg. trans. verb, *know, knew, known*, indic., past., indef., 3rd pers. sing., agr., with '*he*.'
would overcome—irreg. trans. verb, *overcome, overcame, overcome*, potential, past, indef., 3rd pers., sing., agr. with '*he*.'
his—pronom. poss. adj., attrib. to '*enemies*.'
arose—irreg. intrans. verb, *arise, arose, arisen*, indic., past, indef., 3rd pers., sing., agr. with '*he*.'
blew—irreg. intrans. verb, *blow, blew, blown*, indic., past, indef., 3rd pers., sing., agr. with '*he*.'
his—pronom. poss. adj., attrib. to '*horn*.'
three—numeral adj., attrib. to '*times*.'
his—as before, attrib. to '*friends*.'
rejoiced—reg. intrans. verb, indic., past, indef., 3rd pers., plur., agr. with '*friends*.'
his—as before, attrib. to '*enemies*.'
feared—reg. intrans. verb, indic., past indef., 3rd pers., plur., agr. with '*enemies*.'

2. Point out the present participles in the above, and give the past participles of the same verbs.

The present participles with the past participles are :—*sailing, sailed; hearing, heard.*

3. Are the following adjectives compared here correctly:—learned, learneder; beautiful, beautifuler; holy, holier; amiable, amiabler; merry, merrier? Show what rule as to the comparison of adjectives is violated in some of the above examples.

The rule generally followed in comparing adjectives is as follows:—Monosyllables are compared by the terminations *er* and *est*, and words of more than one syllable by the adverbs *more* and *most*. However, dissyllables ending in y are often compared by *-er* and *-est*, and thus while *holier* and *merrier* are allowed, the others should be *more* learned; *more* beautiful, and *more* amiable.

Geography.

1. Describe fully the courses of the rivers which rise in the Cambrian range.

The *Severn* from Plynlimmon flows N.E. through Montgomery, E. and S.E. through Shropshire, S. through Worcester and Gloucester, and falls into the Bristol Channel. Its chief tributaries are the Teme, the Usk, Upper and Lower Avon.

The *Dee* from Arran Fowddy flows northward, separating Cheshire from Wales, and falls into the Irish Sea.

The *Wye* rises on the slopes of Plynlimmon, crosses Radnor and Herefordshire, divides Monmouth from Gloucestershire, and falls into the Bristol Channel.

The *Clwyd* flows through Denbigh and Flint into the Irish Sea.

The *Conway* forms the boundary between Caernarvon and Denbigh, and falls into the Irish Sea.

The *Teify* flows S.W. through Cardiganshire, separates Cardigan from Carmarthen and enters Cardigan Bay.

The *Ystwyth* flows W. through Cardigan into Cardigan Bay.

The *Taff*, the *Neath*, the *Tawe*, and the *Towy* all flow south into the Bristol Channel.

2. Say what you know about the islands and groups of islands lying near the coast of Great Britain.

If you can, draw a map to illustrate *one* answer, and insert the lines of latitude and longitude.

The *Orkney* and *Shetland Islands* form together one county north of the mainland of Scotland. The chief town of the Orkneys is Kirkwall; and of Shetland, Lerwick. The Orkneys are mostly low and fertile; the Shetlands mostly mere stacks of rocks.

The Hebrides form two groups lying along the West of Scotland. The Inner Hebrides lie close along the coast, and consist of Skye, Mull, Jura, Islay, Colonsay, and Oronsay, with some smaller ones: the Outer Hebrides are parted from the Inner by the Minch, the chief being Lewis, Harris, N. Uist, Benbecula, S. Uist, and Barra. Towns:—Portree in Skye, Bowmore in Mull, Stornoway in Lewis.

In the F. of Clyde lie Arran, Bute, Great and Little Cumbræ. Arran and Bute form the county of Bute, with Rothesay as chief town.

In the F. of Forth are the small islands of May, Bass Rock, Inchkeith, and Inchcolm. The Bell Rock lies off the mouth of the Tay.

The Isle of Man lies in the middle of the Irish Sea. Its chief towns are Douglas and Ramsey. The island retains its own government and judges. Its people are called Manx.

The Island of Anglesea forms a distinct county, and is separated from the mainland by the Menai Straits. Its chief town is Beaumaris. Another town, Holyhead on Holy Island, is the point of departure of travellers from England to Ireland.

Lundy Isle lies off Devonshire in the Bristol Channel.

The Scilly Islands are situated to the S.W. of Land's End. Only six are inhabited. The largest is St. Mary.

The Isle of Wight, south of Hampshire, famed for its beauty, is separated from the mainland by the channels of Spithead and the Solent. Its chief towns are Newport, Cowes, Ryde, and Ventnor.

The Channel Islands off the coast of France have belonged to England since the Norman Conquest. They consist of Jersey, Guernsey, Alderney, and Sark.

The Islands of Thanet and Sheppey in Kent are almost a part of the mainland.

The Island of Coquet, Fern Islands, and Holy Island (or Lindisfarn) lie off the shores of Northumberland.

Composition.

Write from dictation the passage given out by the inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Incompatibility*.

Write, in small hand, as a specimen of copy-setting, *A Letter on the Spirit of Patriotism*.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

MALES.

1. What fraction of £9 is $\frac{1}{2}$ of $\frac{9}{10}$ of half-a-crown?

$$\frac{\frac{1}{2} \text{ of } \frac{9}{10} \text{ of } 30\text{d.}}{2160\text{d.}} = \frac{\frac{27}{2}}{2160} = \frac{27}{4320} = \frac{1}{160} \text{ Ans.}$$

2. Reduce $\frac{1}{2}+\frac{1}{3}+\frac{1}{7}+\frac{5}{6}$ to a decimal fraction.

$$\frac{84+42+18+35}{252} = \frac{179}{252} = \frac{44{\cdot}75}{7\times9} = \frac{4{\cdot}972}{7} = {\cdot}71031746. \text{ Ans.}$$

3. A man owns $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{1}{3}$ of a cargo worth £5161 3s. 9d., and sells one-sixth of the whole cargo; what will be the worth of the portion which remains to him?

$\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{1}{3} = \frac{1}{5}$ or $\frac{6}{30}$; and $\frac{1}{6} = \frac{5}{30}$,
∴ by selling $\frac{1}{6}$ he has $\frac{1}{30}$ of the whole left.
$\frac{1}{30}$ of £5161 3s. 9d. = £172 0s. 0½d. Ans.

4. Subtract $\frac{1}{3}$ of $\frac{5}{6}$ from $\frac{3}{4}$ of $\frac{7}{11}$ and multiply the result by $\frac{3}{7}$ of $\frac{5}{8}$.

$$(\tfrac{14}{33} - \tfrac{5}{11}) \times \tfrac{15}{56} = \frac{56-55}{132} \times \frac{15}{56} = \frac{1\times15}{132\times56} = \frac{5}{12\cdot32}. \text{ Ans.}$$

FEMALES.

1. What would it cost to lay down a telegraph for 126 miles 3 fur. 15 po., if 4 miles 2 fur. 30 poles cost £2500?

4 mls. 2 fur. 30. po : 126 mls. 3 fur. 15 po. :: £2500 : ?
or or
1390 po. 40455 po.

$$\frac{£2500\times40455}{1390} = £\frac{1821375}{139} = £72760\ 15\text{s. } 0\tfrac{3}{139}\text{d. } \tfrac{90}{139} \text{ far.}$$

2. A bankrupt whose debts were £1200, only had sufficient to pay his creditors seven shillings and fourpence in the pound; how much had he?

£1 : £1200 :: 88d. : assets.
88d. × 1200 = £440.

3. If 5 needlewomen can do a piece of work in 11 days of 9 hrs. each, how long will it take 3 women to finish two such pieces of work, supposing them to work 10½ hrs. each day?

3 women : 5 women
1 piece : 2 pieces
10½ hrs. : 9 hrs.
} :: 11 days : time required

$$\frac{11 \text{ days}\times5\times2\times9\times2}{3\times21} = \frac{2\,2\,0}{7} = 31\tfrac{3}{7} \text{ days. Ans.}$$

4. If a garrison of 3500 men have provisions to last for 54 days, allowing each man 2 lb. a day, how long would the same provisions last if 500 men were sent away, and the daily allowance increased to 2 lb. 4 oz. each man.

3000 men : 3500 men
36 oz. : 32 oz.
} :: 54 days : time required.

$$\frac{54 \text{ days}\times3500\times32}{3000\times36} = 56 \text{ days. Ans.}$$

Grammar.

1. Point out and parse all the pronouns in the following:—

'And missing thee I walk unseen
On the dry, smooth-shaven green
To behold the wandering moon
Riding near her highest noon
Like one that hath been led astray
Through the heavens' wide pathless way.'—MILTON.

Thee—pers. pron., 2nd pers., sing., com., obj., gov. by '*missing*.'
I—pers. pron., 1st pers., sing., com., nom. to '*walk*.'
her—pers. pron., 3rd pers., sing. fem. pos., attrib. to '*moon*.'
one—indef. pron., 3rd pers., sing., com., obj., gov. by (to) or '*like*.'
that—simple rel. pron., 3rd pers., referring to 'one,' sing., com., nom. to '*hath been led*.'

2. Point out all the objective cases in the above, and explain their government.

Thee is in the objective as the obj. of the action implied in '*missing*'; *green* is the object of the relation implied in *on*; *moon* is the object of the action implied in *behold*; *noon* is the object of the relation implied in *near*; *one* is the object of the relation implied in (to); and *way* the object of the relation implied in *through*.

NOTE.—*Near* and *like* are sometimes considered as adverbs governing the dative object.

3. Pronouns are said to be divided into two classes, substantive and adjective. Give the chief pronouns in each class.

The chief substantive pronouns are:—*I, thou, he, she, it, we, you, they; who, which, that, what; self.*
The chief adjective pronouns are:—*My, thy, his, her, its, our, your, their, my own*, etc.; *this, that, these, those; each, every, either, neither; some, any, one, all, such, other, several, divers; self.*

4. Why is the term adjective-pronoun open to objection? what ground is there for using it?

The term adjective-pronoun is contradictory, because a word can scarcely be considered an adjective and a pronoun at one and the same time; the term is retained because the words to which it applies are *pronouns* in origin, some of them, as *mine* and *thine*, being never used with a noun; others, as *my* and *thy*, never used without a noun, and because most of them are used as *adjectives*.

5. Why can prepositions be only placed before nouns, or words or phrases equivalent to nouns?

As things, and their actions and attributes, can only bear relation to other *things*; and as prepositions are employed to show this relation, therefore they can only be placed before a word that stands for a *thing*, that is, a *substantive*, or a word or phrase equivalent to a substantive.

Geography.

1. Describe fully the courses of the rivers rising in the Cambrian range.

See candidates' paper.

2. Draw a full map of Holland and Belgium, and insert the lines of latitude and longitude.

3. Name *one* seaport in each of the following countries, and describe the situation and character of each:—*Spain, Italy, the Austrian Empire, Russia, Germany.*

Cadiz, in the south of Spain, on the Island of Leon, is strongly fortified, and one of the best harbours in Europe.
Leghorn, a city and seaport of Tuscany, on the west coast of Italy. It ranks as the greatest commercial emporium in Italy, and embraces all the foreign trade of Tuscany.
Trieste, at the head of the Adriatic, stands on the Gulf of Trieste, which is 20 miles long, and of the same breadth at its entrance. It is a free port of Austria, with extensive commerce, and shipbuilding is extensively carried on.
St. Petersburg, the capital of Russia, is situated on both sides of the Neva. It is chiefly built of wood. Its commerce is extensive with all parts of the world, and it has regular steam communication with all the principal ports of Europe. The city is defended by the impregnable fortress of Kronstadt.
Hamburg, a free city of Germany, the greatest commercial emporium of the empire, and perhaps of the continent of Europe, is situated on the Elbe, about 70 miles from its mouth. It is intersected by several canals.

History.

1. Give the dates of Egbert, Alfred, Canute, and Edward the Confessor.

		A.D.	A.D.
Egbert reigned as King of England	from	827	till 836.
Alfred ,, ,, ,,		871	,, 901.
Canute ,, ,, ,,		1016	,, 1035.
Edward the Confessor ,, ,,		1042	,, 1066.

2. What sovereigns reigned between 1100 and 1272? Tell dates as well as names.

	A.D.
Henry I. began to reign	1100.
Stephen ,, ,,	1135.
Henry II. ,, ,,	1154.
Richard I. ,, ,,	1189.
John ,, ,,	1199.
Henry III. ,, ,,	1216 till 1272.

3. Make out a list of our rulers between James I. and Anne, with dates.

	A.D.
James I. began to reign	1603.
Charles I. ,, ,,	1625, executed 1649.
(Commonwealth 1649-1660.)	
Charles II restored	1660.
James II. succeeded	1685, dethroned 1688.
William III. } Mary II. } ,,	1689.
Anne ,,	1702 till 1714.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Incompatibility*.

Write, in small hand, as a specimen of copy-setting, *A Letter on the Spirit of Patriotism.*

Composition.

Write from memory the substance of the passage read to you by the inspector.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. In what time will £1275 amount to £1549 11s. at 3½ per cent. simple interest?

$$\text{Interest} = £1549\ 11s. - £1275 = £274\ 11s.$$

$$\left.\begin{matrix} 3\tfrac{1}{2} : 274\tfrac{11}{20} \\ 1275 : 100 \end{matrix}\right\} :: 1 \text{ year} : \text{time}$$

$$\frac{1 \text{ yr.} \times 5491 \times 100 \times 5}{20 \times 19 \times 1275} = \underline{5\tfrac{3}{5} \text{ years.}} \quad \text{Ans.}$$

2. Find the amount of 1895 guineas for 4¼ years at 2½ per cent.

$$\text{Interest} = £1989\tfrac{3}{4} \times 4\tfrac{1}{4} \times \frac{2\tfrac{1}{2}}{100} = \frac{£7959 \times 19 \times 11}{4 \times 4 \times 400}$$

$$= £259\ 18s.\ 2\tfrac{11}{16}d.$$

$$\text{Principal} = \underline{£1989\ 15s.\ 0d.}$$

$$\therefore \text{Amount} = \underline{£2249\ 13s.\ 2\tfrac{11}{16}d.} \quad \text{Ans.}$$

3. What sum of money, lent at 5 per cent. simple interest, will produce, in 4 years, the same amount of interest as £250, lent at 3 per cent., produces in 6 years?

$$\left.\begin{matrix} 5 \text{ p.c.} : 3 \text{ p.c.} \\ 4 \text{ yrs.} : 6 \text{ yrs.} \end{matrix}\right\} :: £250 : \text{sum}$$

$$\frac{£250 \times 3 \times 6}{5 \times 4} = \underline{£225.} \quad \text{Ans.}$$

4. If a house contains property worth £17,230, and is insured for only 86·3 per cent. of its value, what sum does the owner lose in case of its destruction by fire.

Every £100 of the value loses £13·7.

$$\therefore \text{total loss} = \frac{£17{,}230 \times 13{\cdot}7}{100} = £2360{\cdot}51.$$

$$= \underline{£2360\ 10s.\ 2\tfrac{1}{2}d.} \quad \text{Ans.}$$

FEMALES.

1. Simplify. $\dfrac{\frac{1}{2} + 1\frac{1}{5} + 2\frac{1}{3}}{\frac{1}{2} \text{ of } 1\frac{3}{5} - \frac{1}{3} \text{ of } \frac{4}{5}}$

$$\frac{\frac{1}{2} + \frac{8}{5} + \frac{13}{15}}{\frac{8}{5} - \frac{4}{15}} \times \frac{30}{30} = \frac{15 + 36 + 65}{24 - 8} = \frac{116}{16} = \underline{7\tfrac{1}{4}}. \quad \text{Ans.}$$

2. If ⅔ of a gallon of brandy be worth ⅞ of a gallon of whisky and whisky be worth 16s. 4d. per gallon, how many gallons of brandy can be bought for £71 16s. 3¾d.?

$$\tfrac{2}{3} \text{ gall. of brandy} = \tfrac{7}{8} \text{ of } 16s.\ 4d.$$

$$= 14s.\ 3\tfrac{1}{2}d.$$

$$\therefore 1 \text{ ,,} = 14s.\ 3\tfrac{1}{2}d. \times \tfrac{3}{2} = 21s.\ 5\tfrac{1}{4}d.$$

$$\frac{£71\ 16s.\ 3\tfrac{3}{4}d.}{21s.\ 5\tfrac{1}{4}d.} = \frac{68943}{1029} = \underline{67 \text{ galls. of brandy.}}$$

3. A man spends ⅖ of his weekly wages in food, 1/10 in clothing, 9/70 in rent, 2s. 3d. in clubs, and lays by 1s. What are his weekly earnings?

$$\tfrac{2}{5} + \tfrac{1}{10} + \tfrac{9}{70} = \frac{42 + 7 + 9}{70} = \tfrac{58}{70} \text{ part spent in food, clothing, and rent.}$$

$$\therefore \tfrac{6}{35} \text{ of whole} = 3s.\ 3d. \text{ or the whole} = \frac{3s.\ 3d. \times 35}{6} = \underline{18s.\ 11\tfrac{1}{2}d.}$$

4. How much will it cost to clothe ten thousand soldiers, if a coat takes 1¾ yd., a pair of trousers 1½ yd., and a waistcoat ¾ yd., the price of the material being 16s. 9½d. a yard, and the cost of making each suit 9s. 4d.?

$$1 \text{ suit} = 1\tfrac{3}{4} + 1\tfrac{1}{2} + \tfrac{3}{4} = 4 \text{ yds.}$$

$$\text{Each suit costs } (16s.\ 9\tfrac{1}{2} \times 4) + 9s.\ 4d. = (67s.\ 3d. + 9s.\ 4d.)$$

$$= £3\ 16s.\ 7d.$$

			£	s.	d.
Value of 10,000 suits at £3 each =			30,000	0	0
,, ,,	15s. ,,	= ½ at £3 =	7,500	0	0
,, ,,	15d. ,,	= 1/15 ,, 15s. =	625	0	0
,, ,,	3d. ,,	= ⅛ ,, 15d. =	125	0	0
,, ,,	1d. ,,	= ⅓ ,, 3d. =	41	13	4
			£38,291	13	4

Grammar.

1. 'The rugged *mountain's* scanty cloak
Was dwarfish *shrubs* of birch and oak,
With *shingles bare* and cliffs *between*
And patches bright of bracken green
And heather black *that* waved *so high*,
It held the copse in rivalry.'—SCOTT.

(*a*) Parse all the words in italics.

(*b*) Is the sentence in the last line a principal or a subordinate sentence? Give the reason of your answer.

(*c*) What are verbs of incomplete predication? Give an example of one from the above, pointing out what is the complement of the predicate.

(*a*) *Mountain's*—Com. noun, neut., sing. poss., attrib. to '*cloak*.'

shrubs—com. noun, neut., plur., nom., in apposition with '*cloak*,' or nom. after '*was*.'

shingles—com. noun, neut., plur., obj., gov. by '*with*.'

bare—adj. qual. '*shingles*.'

between—prep. gov. (*them*).

that—simple rel. referring to '*heather*,' 3rd pers., sing. neut., nom. to '*waved*.'

so—adv. of degree, mod. '*high*.'

high—adv. manner, mod. '*waved*.'

(*b*) The last sentence, '(*that*) it held the copse in rivalry,' is a subordinate adverbial sentence of effect. It shows the effect of the high waving of the heather, and depends on the preceding

sentence for the meaning, entering into its signification like an adverbial phrase. The last two sentences might read together thus: 'It waved in rivalry with the copse.'

(*c*) Verbs of incomplete predication are those which do not make complete sense by themselves, but require some other word to be used with them to make the sense complete. 'Was' requires 'dwarfish shrubs of birch and oak' to complete the meaning; and 'held' requires 'in rivalry,' 'held the copse' not being sufficient to give the full meaning.

2. What are conjunctive adverbs? Why are they so called? Give examples of their use.

Conjunctive adverbs are such as both connect the sentence which they introduce with the preceding, and at the same time modify the verb in the sentence which they introduce; acting thus the part of both an adverb and a conjunction. They connect subordinate adverbial sentences with the principal; as, I shall go *when* I am ready. I waited *while* he wrote. The troops bivouacked *where* they fought.

Geography.

Answer Q. 2 or Q. 3; not both.

1. Draw a full map of Holland and Belgium, and insert the lines of latitude and longitude.

2. Give notes of a *first* lesson on 'The British Colonies,' describing generally their position and character, and pointing out for what purposes each of them is useful.

NOTE.—*Lesson to be given before a map of the world.*

DEFINITION OF COLONY.—Colony is a foreign possession peopled by emigrants from a parent state. A British colony is peopled by settlers from Britain, which is called the mother country. Explain difference between 'emigrant' and 'colonist,' difference between a colony and a dependency. Australia is, properly speaking, a colony; India, a dependency.

POSITION OF THE COLONIES.—British colonies are not confined to any quarter of the world, but are scattered over all parts of its surface. In Europe are Heligoland, Gibraltar (the key of the Mediterranean), Malta, in the Mediterranean. In Asia are India, Ceylon, Hong Kong, Straits Settlements, Aden and Perim. In Africa are Cape Colony and others in the south, and Sierra Leone and others on the West Coast. St. Helena, Ascension, and Mauritius, off the coast. In America are Canada, British Columbia, and the most of the Leeward and Windward islands of the West Indies, with Jamaica, Bahamas, Trinidad, British Guiana, Honduras, and the Falkland Islands. Australia and New Zealand.

CHARACTER AND VALUE OF THE COLONIES.—Colonies indirectly confer great advantages on the mother country. One of the most valuable is that they furnish a new home for thousands of poor, who find it a hard struggle to live in their own country. Canada, Cape Colony, Australia, and New Zealand are especially adapted for this. Others are valuable as stations for sheltering our fleets, and consequently protect our commerce; such are Heligoland, Gibraltar, Malta, Mauritius. Others are trading stations, in which raw produce from the surrounding countries may be collected, or from which English goods may be distributed to them. Singapore and the settlements in West Africa are of this character. Others are useful as stations or half-way houses at which ships may call to take in water or provisions or coal; for example, Gibraltar, St. Helena, Mauritius, Aden, and the Falkland Islands.

3. Write a letter, as from a young man travelling in Hindostan, describing the cultivation of the *Poppy*, *Indigo*, *Rice*, *Tea*, and *Pearl* fishing; and distinguishing the different parts of the country where each of these occupations is carried on.

Calcutta, 26th Aug., 1882.

SIR,—The *Poppy*, from which opium is produced, grows principally in Bengal, parts of Bombay, and Malwa. This plant is one of the important plants of India, its production and sale forming a Government monopoly. The narcotic known as opium is the thickened juice of a white poppy. This juice is obtained by scratching the seed-vessels while still unripe, when a milky fluid runs out, which hardens in the sun, and is then kneaded into balls, and packed in chests for export.

Indigo is chiefly produced in Bengal, in the delta of the Ganges. This plant is a native of India, from which country it takes its name. To obtain the dye, the plants are cut down when they begin to flower, and are steeped in water until they slightly ferment. When the fermentation ceases, the water is drawn off and violently agitated. It is then allowed to settle, and a thick sediment forms at the bottom, which sediment drained and dried is the indigo of commerce. The seeds are sown in spring at the rate of about a dozen pounds per acre. The plants grow rapidly, blossom in about three months, are cropped, and allowed to grow again. They are cropped a second, a third, and sometimes even a fourth time, when the process given above is gone through to procure the colouring matter.

Rice, which forms the staple food of the inhabitants, grows on the bank of the lower Ganges, and all around the sea-coast. Its cultivation requires an immense quantity of moisture, and grows best in fields which are, or can be, inundated. It is generally sown while the waters cover the land. The plants are also grown from cuttings, which are steeped in water first and then placed in the soil or mud brought down by the flooded river. When six inches high these are planted into rows one foot apart.

Tea is grown in the moist warm valleys of the Himalaya mountains, and particularly in Assam, where the plant was found growing wild. This plant is a hardy evergreen, from three to six feet in height. The plant is propagated by seeds on light, strong ground, and requires an abundance of light and air. The plants are sown five or six in a hole in rows four or five feet asunder. The first crop is gathered when the plant is three years old.

Pearls are procured from the inside of a species of oyster, found in great abundance on the rocky shores of the island of Ceylon. The oysters are generally found adhering to the rocks at a considerable distance below the surface of the sea, and are obtained by divers, who earn a precarious livelihood by this dangerous occupation. Loaded with weight sufficient to sink him the poor diver descends with a basket or bag, and after gathering as many oysters as he can, at a signal he is hauled to the surface, and the oysters are laid in pits to decay; because if the shells were forced open the pearls might be damaged.

I am, Sir,
Your obedient servant,
A TRAVELLER.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Give the date of the Saxon Invasion, and explain what brought it about.

According to the common account the Invasion of Britain by the Saxons began in 449 A.D. After the departure of the Romans, the Britons found themselves unable to cope with the Picts and Scots, who broke in from the north and ravaged the country. In their despair they asked the aid of a band of Saxon sea-rovers, who, under the command of Hengest and Horsa, came to England, and obtained the Island of Thanet on condition that they fought their battles against the Picts and Scots. They defeated the enemies of Britain, and seeing the weakness of those who got their help, they invited others of their countrymen who came, and gradually the land fell an easy conquest to the bold but unscrupulous free-booters.

2. When and where was Magna Charta signed? Mention some of its provisions, and explain how the king came to accept them.

Magna Charta was signed by King John, at Runnymede, a meadow on the Thames, not far from Windsor, in June, 1215.

Some of the chief provisions of Magna Charta were these:—The king was not to demand or exact sums of money from the people without the consent of the Great Council of the nation, which council was to be called regularly and frequently. No freeman was to be imprisoned or have his goods taken from him but by the judgment of his equals, or by the law of the land; and no one, not even the villain or serf, was to be heavily fined for a small offence.

The king was forced to accept the Charter by the nobles and commons, headed by Stephen Langton.

3. When and by whom was printing introduced into England? Show the importance of that invention.

The reign of Edward IV. is distinguished by the introduction of printing, when, in 1474, Caxton set up a printing press in the Almonry of Westminster.

In all modern history no event has had wider or more lasting consequences than the invention of printing. A complete change took place not only in book-making but in the facility for diffusing learning. Since Caxton's time types have multiplied by millions, and printing presses by hundreds. A little silver coin can now buy the book for which Caxton charged a piece of gold. The British cottage is indeed a poor one which cannot show some volumes as well printed and as finely bound as his finest works. Without the invention of printing the spread of the Reformed doctrines must have been seriously checked, if not prevented, but the printing-press multiplied copies of the Bible at a rate and a cost which brought the Word of Truth within the reach of all classes. Neither the poet nor the philosopher, the historian nor the divine, could have made an impress on the spirit of his age without such an aid. Learning, instead of being as it now is the property of the many, must have been the exclusive privilege of the few.

Composition.

Write full notes of a lesson on *Bread.*

OBJECTS TO BE SEEN AND HANDLED.—*A wheat plant bearing seed—rye, oats, barley, all as seeds—chaff—wheat grain free from chaff—whole meal—bran—flour—yeast—bread—biscuits—oatmeal—and things of a kindred nature.*

WHAT BREAD IS MADE FROM.—Bread made from wheat—rye—oats—barley—principally from wheat—(*describe sowing—growing—reaping—and gathering wheat crops*)—grain freed from straw and ear—then from chaff—ground in a mill—bran taken from flour—whole meal a mixture of flour and bran—baked into brown-bread—flour sifted and given off in different degrees of fineness.

BREAD-MAKING—(1) *Setting the Sponge.* Baker puts as much flour as he requires into a bin—mixes this with water and yeast, and forms 'dough'—yeast causes dough to swell (why) and the 'sponge rises'—this mixture after sitting some time is mixed with salt which flavours it—lastly, it is mixed with more flour and water—thoroughly kneaded—and after some *fermentation* the dough is made into the form of loaves. (2) *Baking.*—The loaves are placed in the oven (describe)—heat of oven kills yeast—loaves take a longer or shorter time to bake according to the size of the oven—*ship biscuits* examples of unfermented bread. Oatmeal cakes made in Scotland—in Spain bread from chestnuts—in North and South America from maize.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Incompatibility.*

Write, in small hand, as a specimen of copy-setting, *A Letter on the Spirit of Patriotism.*

Euclid.

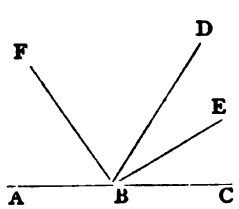
MALES.

[All generally understood abbreviations for *words* may be used.]

1. Upon the same base, and on the same side of it, there cannot be two triangles that have their sides which are terminated in one extremity of the base equal to one another, and likewise those which are terminated in the other extremity.

Prop. 7, Bk. 1.

2. DB meets the straight line ABC at B; BE BF bisect the angles DBC, ABD. Show that FBE is a right angle. (Apply Prop. 13.)



Because DBF, DBE are equal to half the sum of DBA, DBC, and since DBA, DBC are (Prop. 13) equal to *two* right angles, then DBF, DBE are together equal to *one* right angle.

Q.E.D.

3. The greater side of every triangle is opposite to the greater angle.

Prop. 18, Bk. 1.

Needlework.

FEMALES.

One hour allowed for this Exercise.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. A man invested 9000 guineas in the 3 per cents. at 81, and sold out when they had sunk to 67½; what did he lose by the transaction?

He loses on every £100 stock £(81 − 67½), or £13½
∴ his total loss = £($13\frac{1}{2} \times \frac{9000}{100}$) = £1275 15s. Ans.

2. If 20 lbs. Troy of pure gold are coined into 934 sovereigns and a half-sovereign; and if standard gold contains 12 parts of pure gold to one part of alloy, what is the weight of pure gold in a sovereign?

Weight of sov. if all pure gold $= \frac{20 \text{ lbs.}}{934\frac{1}{2}} = \frac{115200}{934\frac{1}{2}}$ grs. $= \frac{230400}{1869}$ grs.
$= 123\frac{273}{1869}$ grs. Ans.

3. State the rule for working compound proportion, and explain the reason for it. If 15 horses and 148 sheep can be kept 9 days for £75 15s., what sum will keep 10 horses and 132 sheep for 8 days, supposing 5 horses to eat as much as 84 sheep?

Find the number which is of the same kind as the required answer, and place it in the third term, as in simple proportion.

Take any two terms which are of the same kind and consider these two with the third as a separate sum in simple proportion. If the answer is to be greater than the third term, put down the greater for the second term, if less, put down the less, and the remaining number for the first.

Then take other two terms which are of the same kind, and treat them with the third term, as another distinct sum in simple proportion. State it also according to the same rule. Proceed in the same manner till all the terms are disposed of.

Arrange all the separate ratios beneath the other; then multiply all the first terms together for a new first term and all the second terms together for a new second term.

Then multiply this new second term by the third, and divide by the first as in simple proportion.

The employment of this rule depends on the following principle:—

If there be three quantities so related that when all other things are equal the first varies as the second, and also when all other things are equal the first varies as the third; the variations of the first is as the product of the second and third.

Generally. If a increases as b increases, and also as c increases, then the total increase of a is as $b \times c$.

5 horses are equivalent to 84 sheep
∴ 1 horse is ,, 16¾ ,,
and 15 horses are ,, 252 ,,
,, 10 ,, ,, 168 ,,

15 horses + 148 sheep : 10 horses + 132 sheep :: £75 15s. : ?
or or
400 sheep : 300 sheep
9 days : 8 days

$\frac{£75\ 15s. \times 300 \times 8}{400 \times 9} = £50\ 10s.$ Ans.

4. Find the cost of papering a room 20 feet long, 16½ feet broad, and 12 feet high, the price of a piece of paper 12 yards long and 3 quarters broad being 4s. 6d.

area of side walls = (20 ft. × 12 ft.) × 2 = 480 sq. ft.
,, end ,, = (12 ft. × 16½ ft.) × 2 = 396 ,,
Total = 876 ,,
,, piece of paper = 36 ft. × 2¼ ft. = 81 ,,
81 sq. ft. : 876 sq. ft. :: 4s. 6d. : ?

$$\frac{54d. \times 876}{81} = \underline{£2\ 8s.\ 8d.}\ \text{Ans.}$$

FEMALES.

1. Divide ·2 by ·06 and 6·35 by ·425, each to 4 places of decimals, and prove the truth of each result by fractions.

(a) ·06)·200000
3·3333

Proof $\frac{·2}{·06} = \frac{2}{10} \div \frac{6}{100}$
$= \frac{2}{10} \times \frac{100}{6}$
$= \frac{2}{6} \times \frac{100}{10}$
$= \frac{2}{6} \times \frac{100000}{10000}$
$= \frac{200000}{6} \times \frac{1}{10000}$

Now $\frac{200000}{6} = 33333$...from above
therefore the result $= \frac{33333}{10000}$
$= \underline{3·3333}$...Ans.

·425)6·35(14·9411
4 25
2 100
1 700
4000
3825
1750
1700
500
425
750
425

Proof $\frac{6·35}{·425} = \frac{635}{100} \div \frac{425}{1000}$
$= \frac{635}{100} \times \frac{1000}{425}$
$= \frac{635}{425} \times \frac{1000}{100}$
$= \frac{635}{425} \times \frac{1000}{10000}$
$= \frac{635000}{425} \times \frac{1}{10000}$

Now $\frac{635000}{425} = 1494\frac{1}{17}$...from above
therefore $\frac{1494\frac{1}{17}}{10000} = \underline{14·9411}$...Ans.

2. What number added to the sum of
·0007 + 2·4 + ·05 + 3·0436 + ·047 will make an integer?

·0007
2·4
·05
3·0436
·047
5·5413

To make 5·5413 an integer we must add some decimal fraction to it to make 6.
Therefore 6 − 5·5413 = ·4587. Ans.

3. Add $4\frac{2}{4}$, $\frac{123}{100}$, $4\frac{2}{25}$, $5\frac{11}{2500}$, by vulgar and decimal fractions, and show that the results agree.

	V. F.	D. F.
$4\frac{2}{4} =$	$4\frac{1275}{2500} =$	4·75
$\frac{123}{100} =$	$\frac{615}{2500} =$	·246
$4\frac{2}{25} =$	$4\frac{200}{2500} =$	4·08
$5\frac{11}{2500} =$	$5\frac{211}{2500} =$	5·0088
	$14\frac{63}{2500} =$	14·0848. Ans.

4. A man has £3150 in hand having lost ·6 of his property in a farm, and purchased a house with ·125 of the remainder. What was he worth at first?

(a) After losing ·6 or $\frac{6}{10}$ he has $\frac{4}{10}$ remaining.
(b) ·125 of $\frac{4}{10} = \frac{1}{8}$ of $\frac{4}{10} = \frac{1}{20}$ of the whole.
(c) $\frac{6}{10} + \frac{1}{20} = \frac{13}{20}$ of the whole spent and lost; leaving $\frac{7}{20}$ of the whole in hand.

$$£3150 \div \tfrac{7}{20} = £\frac{3150 \times 20}{7} = \underline{£9000}.\ \text{Ans.}$$

Grammar.

1. 'Though I look old, yet I am strong and lusty;
For in my youth I never did apply
Hot and rebellious liquors in my blood:
Therefore my age is as a lusty winter,
Frosty, but kindly.'

(a) Point out the principal sentences in the above.
(b) In the first line which is the consequent cause, and which is the hypothetical or conditional clause? Why are such clauses so called?
(c) Point out the conjunctions in the above passage, and state to which class they belong.

(a) The principal sentences are (1) *I am strong and lusty;* (2) *My age is as a lusty winter, frosty, but kindly.*
(b) In the first line the consequent clause is 'I am strong and lusty,' and the hypothetical, 'I look old.' These sentences are so named from the ideas involved in their meaning; the conjunction 'though' introducing the conditional, and 'yet' the consequent clause. These clauses occur in reasoning, the one following as a consequence from the hypothesis.
(c) '*Though*'—subordinate, concessive, or conditional conj.
'*Yet*'—co-ordinate adversative ,,
'*For*'—subordinate causal ,,
'*And*'—co-ordinate copulative ,,
'*Therefore*' ,, illative ,,
'*As*'—subordinate adverbial ,,
'*But*'—co-ordinate adversative ,,

2. Into what classes may adverbial sentences be divided? Give an example from each class.

Adverbial sentences may be divided into those relating to:—
(1) *Time*, as, Every one listens *when he speaks.*
(2) *Place*, as, He stands *where I left him.*
(3) *Manner*, as, He did *as he was told.*
(4) *Degree*, as, *The more he learns*, the more he wishes to learn.
(5) *Cause*, as, He could not have seen me, *for I was not there.*
(6) *Purpose*, as, He labours *that he may grow rich.*
(7) *Condition*, as, *If your letter is finished* bring it to me.

3. What are the Latin prepositions which enter into the composition of each of the following words:—Collision, counteract, deluge, illusion, pellucid? Give the meaning of each preposition.

*Col*lision is compounded with *col* for *con* (together).
*Counter*act ,, ,, *counter* for *contra* (against).
*De*luge ,, ,, *di* for *dis* (apart).
*Il*lusion ,, ,, *il* ,, *in* (into).
*Pel*lucid ,, ,, *pel* ,, *per* (through).

Geography.

Answer *two* questions.

1. Give notes of a lesson on the course of a ship sailing from Athens to Constantinople, round the Black Sea, and then, along the coast, to Alexandria.

Illustrate by a map, and insert the lines of latitude and longitude.

Leaving Athens, more famed for the ruins of its former greatness than for its present importance, we round Cape Colonna, with the remains of a temple of Minerva, and sail north up the channel of Negropont and Talanti, across which is a bridge connecting the island with the mainland. Leaving the channel, we skirt the Turkish shores northwards to Salonica, where a peninsula projects and divides into three parts, forming the Gulfs of Cassandro and Monte Santo, the latter name being also given to the peninsula, with monasteries strictly forbidding any being of the female sex to enter. Passing the Gulf of Contessa, and the Island of Thaso, we come to Enos, the port of Adrianople. We now reach the tongue of land which forms the western boundary of the Dardanelles. The entrance to this famous passage is defended by forts on either side.

The principal town on the European side is Gallipoli. Entering the Sea of Marmora we voyage to Constantinople (*a full description to be given*) on the Bosphorus, the entrance to the Black Sea, into which we sail, turning north to Cape Emineh, the termination of the Balkans, and Varna, whence the Crimean expedition set out in 1854. The coast now bends to the N.E. to the mouths of the Danube (*describe delta*). Continuing our course we come to Odessa, with grain exports; then to Kherson, where Howard died; and afterwards to Perekop, the key to the Crimea. *Crimea to be noted, also Eupatoria, the Alma, Sebastopol, Balaklava, Inkerman, etc.* Turn N.E. to Kaffa, pass Straits of Yenikale, to Kertch, and Taganrog, in our coasting the Sea of Azov. Returning through the Straits of Yenikale, and soon finish the European coast.

Continuing our voyage, we coast the southern shore of the Black Sea, and pass Poti, Batoum, Trebizond, Sinope, where the Turks were massacred by the Russians in 1853, Cape Baba, and reach Scutari, a suburb of Constantinople, famous for the hospital in which Miss Nightingale laboured. Proceeding through Sea of Marmora and the Dardanelles, we pass Besika Bay, the resort of our war vessels when the Russians threatened Constantinople, Smyrna (*note*), Isle of Rhodes, famous for its Colossus, Island of Cyprus, now a British possession, to Scanderoon, the port of Aleppo. Southwards we sail to Beyrout, the port of Damascus, Acre, Jaffa, and Gaza, and soon after by an easterly course we reach Port Said and Alexandria. (*Notes on the Nile, Delta, and Suez Canal.*)

2. Describe, as fully as you can, the rivers of Africa flowing into the Atlantic Ocean, mentioning how much has been found out about them by recent explorers.

The rivers of Africa flowing into the Atlantic are the *Senegal*, *Gambia*, *Niger*, *Congo*, and *Orange*.

Of these the *Senegal*, the *Gambia*, and the *Niger* have their origin in the mountains near the coast of Senegambia. In the rainy reason the *Senegal* is navigable for about 600 miles, and in the dry season for about a fourth of that distance. The *Gambia* takes a winding course to the west, and is navigable for 400 miles, nearly the whole of its extent. The greatest of these rivers is the *Niger*, called by the natives in the upper part of its course the *Joliba*, and lower down the *Quorra*, enters the ocean by a number of mouths, the most distant of which are 200 miles apart. It is navigable for light vessels above Timbuctoo. The sources of this river were discovered in 1879 by a French expedition which started from the coast of Sierra Leone. Its head waters are formed by two streams, both of which have their origin in the Loma Mountains.

The *Congo*, the second in extent of basin and the greatest in volume of the African rivers—so characterized by Stanley who explored it in 1876–77—rises in the mountains above Lake Nyassa and falls into Lake Bangweolo, from which it issues under the name *Lunpula* and flows north to Lake Moero. From the north side of this lake issues the *Lualaba*, which passes through a magnificent series of lake expansions, and receives numerous tributaries. About the place where this river crosses the equator there are six falls, and further on there begins a series of cataracts and rapids which interrupt the navigation for about 180 miles. Unlike most African rivers the Congo forms an estuary at its mouth. It is estimated to pour into the ocean a larger body of water than the Mississippi.

The Orange River, though it rises near the eastern coast and flows nearly across the Continent, passes for the greater part of its course through the desert, receives the Vaal, and is a shallow stream. The country on the Vaal has of late years attracted attention as the deposit of perhaps the richest diamond fields in the world. The obstructions in its bed are likely to hinder its ever becoming a great commercial highway.

SECOND PAPER.

Two hours and a half allowed.

History.

1. When and how were the Crowns of England and Scotland united?

The Crowns of England and Scotland were united in the person of James VI. of Scotland, who became James I. of England, 1603. James was by both father and mother's side great-grandson of Margaret, daughter of Henry VII., and as he was the next heir to the throne upon the death of Elizabeth, he succeeded without opposition.

2. Who was the last of our Stuart sovereigns? Give some account of the European wars of England in this reign.

Queen Anne was the last of our Stuart sovereigns, and in her reign was carried on the war of the Spanish succession, which continued from 1702 till 1713. In 1702 England declared war against France and Spain, and Marlborough was appointed to the chief command of the forces. His great assistant in the struggle was Prince Eugene of Savoy. The scenes of the conflict for the English forces were chiefly the low countries; the coast of Spain; the interior of Spain; and the West Indies. On the first two theatres of warfare brilliant success was obtained, but on the other the results were against the English. However, France was humbled in four great battles. At Blenheim, Marlborough defeated Marshal Tallard in 1704, at Ramilies he defeated Villeroi in 1706; in 1708 the French lost 15,000 men at Oudenarde, and at Malplaquet in 1709 a still bloodier victory was won. One of the most important achievements of the war was the capture of Gibraltar, 1704. The war lingered on till 1713, when the Treaty of Utrecht put a stop to it, and gave England Hudson Bay, Newfoundland, Nova Scotia, allowing her also to retain Gibraltar and Minorca, which had been taken from Spain.

3. What was the condition of England at sea during the war of American Independence? Describe the career and exploits of Rodney, and show their national importance.

During the War of Independence England saw Spain and France united against her (1779) and their fleets were for a time possessors of the sea. A French invasion of England was threatened, but it came to nothing. In January, 1780, our naval power re-asserted itself, when Admiral Rodney defeated the Spanish fleet off Cape St. Vincent. In 1782 again the French and Spanish fleets swept the Channel, for England had not yet risen to her full strength on the sea. Before the close of the war, however, another exploit of Rodney's redeemed the English name. In April, 1782, between the isles of Guadaloupe and Dominica, Rodney attacked and routed the French fleet under the Count de Grasse, sailing from Martinique to assail Jamaica. Five French first-rate ships of the line were taken, including the flag-ship with De Grasse on board, and one was sunk. Admiral Hood captured two more ships in the pursuit. An immense sum of money and the whole train of siege artillery were taken, and Jamaica was saved. Rodney was made a peer for this great service to the nation.

Algebra.

MALES.

1. Divide $\frac{3x^3}{2} - \frac{31x^2y}{12} + \frac{7xy^2}{8} - \frac{9y^3}{16}$ by $\frac{x}{2} - \frac{3y}{4}$

$$\frac{x}{2} - \frac{3y}{4}\Big)\frac{3x^3}{2} - \frac{31x^2y}{12} + \frac{7xy^2}{8} - \frac{9y^3}{16}\Big(3x^2 - \tfrac{3}{2}xy + \tfrac{3}{4}y^2. \text{ Ans.}$$

$$\frac{3x^3}{2} - \frac{9x^2y}{4}$$

$$-\tfrac{1}{3}x^2y + \frac{7xy^2}{8}$$

$$-\tfrac{1}{3}x^2y + \frac{4xy^2}{8}$$

$$\frac{3xy^2}{8} - \frac{9y^3}{16}$$

$$\frac{3xy^2}{8} - \frac{9y^3}{16}$$

2. Find the G.C.M. of x^2+5x+4, $2x+x^2-8$, and $12+7x+x^2$.

Factorizing x^2+5x+4 we get $(x+1)(x+4)$

" x^2+2x-8 " $(x-2)(x+4)$

" $x^2+7x+12$ " $(x+3)(x+4)$

$\therefore$ $x+4$ is the G.C.M. Ans.

3. Solve the equations:—

$$(1)\ \frac{5x-1}{2} - \frac{7x-2}{10} = 6\tfrac{1}{2} - \frac{x}{2}$$

$$(2)\ \frac{10x+7}{18} = \frac{12x+2}{11x-8} + \frac{5x-4}{9}$$

(1) Clearing of fractions $25x - 5 - 7x + 2 = 66 - 5x$

$$25x - 7x + 5x = 66 + 5 - 2$$

$$23x = 69$$

$$x = 3. \text{ Ans.}$$

(2) Transposing, reducing to com. denr.

$$\frac{10x+17}{18}-\frac{10x-8}{18}=\frac{12x+2}{11x-8}$$

Subtracting fractions $\frac{2}{18}=\frac{12x+2}{11x-8}$

$$275x-200=216x+36$$
$$59x=236$$
$$x=4. \text{ Ans.}$$

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Incompatibility*.

Write, in small hand, as a specimen of copy-setting, *A Letter on the Spirit of Patriotism.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. Define *rhombus, rhomboid, trapezium, parallel, straight lines, parallelogram.*

To draw a straight line through a given point parallel to a given straight line.

A *Rhombus* is a four-sided figure having all its sides equal, but its angles are not right angles.

A *Rhomboid* is a four-sided figure having its opposite sides equal, but all its sides are not equal, nor its angles right angles.

A *Trapezium* is a four-sided figure, but not a parallelogram. Some restrict the word trapezium to be a four-sided figure which has two of its sides parallel.

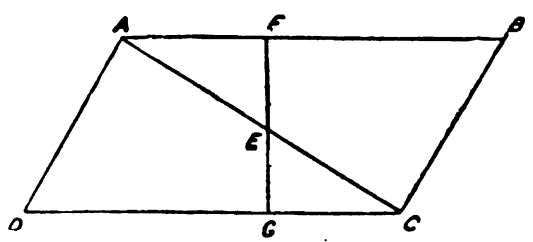
Parallel refers to the straight lines which are in the same plane, and which being produced ever so far both ways do not meet.

Straight lines are lines which lie evenly between their extreme points.

A *Parallelogram* is a four-sided figure which has its opposite sides parallel and equal.

(Prop. 31, Bk. I.)

2. Bisect a parallelogram by a line drawn at right angles to one of the sides.



Let ABCD be a parallelogram; draw the diagonal AC, which bisect in E (this may be readily done by means of the diagonal BD). From E let fall the perpendicular EG, and produce GE to meet AB in F. Then evidently the angle at F is a right angle since AB is parallel to DC.

Now because AE=EC, angle EAF=angle ECG, and the angle AFE=the angle EGC, then (I. 26) the triangle AFE=the triangle CGE. Again, since AC bisects the parallelogram (I. 34), then by substituting the one triangle for the other, the trapezium AFGD=the trapezium CGFB, that is, the parallelogram is bisected by FG, a straight line drawn perpendicular to one of the sides. Q. E. F.

3. Equal triangles upon equal bases in the same straight line, and towards the same parts, are between the same parallels.

(Prop. 40, Bk. I.)

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. A creditor receives on a debt of £296 a dividend of 12s. 4d. in the pound, and he receives a further dividend upon the deficiency of 3s. 9d. in the pound. How much does the creditor receive in all?

First payment $=\frac{12\text{s. }4\text{d.}}{24\text{cd.}}$ or $\frac{37}{60}$ of the whole $=\frac{185}{296}$

Second " $=\frac{3\text{s. }9\text{d.}}{240}$ of $\frac{37}{60}$ or $\frac{5}{16}$ of $\frac{37}{60}$ " $=\frac{185}{1536}$

Total payment equivalent to $\frac{461}{768}$

$\frac{461}{768}$ of £296 = £203 16s. 2d. Ans.

2. Divide £11,875 among A, B, and C, so that as often as A gets £4, B shall get £3, and as often as B gets £6, C shall get £5.

While A gets 4 shares or 8
" B " 3 " " 6
and C " $\frac{5}{6}$ of 3 or $2\frac{1}{2}$ " " 5
} total 19

		£	£
∴ The proportions are	A's, $\frac{8}{19}$ of 11875	=	5000 Ans.
"	B's, $\frac{6}{19}$	"	= 3750 Ans.
"	C's $\frac{5}{19}$	"	= 3125 Ans.

3. Simplify these three expressions—

$$\frac{\frac{3}{4}\text{ of }\frac{2}{3}}{\cdot15+\frac{3}{8}};\quad \frac{4\frac{2}{3}}{2\cdot3};\quad \frac{\cdot284}{\frac{7}{8}\times\frac{1}{8}}$$

Give the answers in vulgar fractions.

(a) $\frac{\frac{3}{4}\text{ of }\frac{2}{3}}{\cdot15+\frac{3}{8}}=\frac{\frac{6}{12}}{\frac{3}{20}+\frac{3}{8}}=\frac{6}{17}\div\frac{21}{40}=\frac{8\times40}{27\times21}=\frac{320}{567}$ Ans.

(b) $\frac{4\frac{2}{3}}{2\cdot3}=\frac{14}{3}\div\frac{23}{10}=\frac{32\times10}{7\times23}=\frac{320}{161}=1\frac{159}{161}$ Ans.

(c) $\frac{\cdot284}{\frac{7}{8}\times\frac{1}{8}}=\frac{284}{1000}\div\frac{7}{64}=\frac{284\times35}{1000\times8}=\frac{497}{560}=1\frac{97}{112}$ Ans.

4. How much stock can be purchased by the transfer of £2000 stock from the 3 per cents. at 90 to $3\frac{1}{2}$ per cent. stock at 96, and what change in annual income will be produced by the transfer?

(a) 96 : 90 :: £2000 : stock required.

$$\frac{£2000\times90}{96}=£1875$$

	£	s.	d.
Income in first case = £2000 × $\frac{3}{100}$ =	60	0	0
" second " = £1875 × $\frac{3\frac{1}{2}}{100}$ =	65	12	6

∴ income is increased by £5 12 6 Ans.

FEMALES.

1. If I lend a friend £1200 at 4 per cent. simple interest, and tell him to keep it until principal and interest amount to £1666 13s. 4d., how long will he have it?

Interest for time = £1666 13s. 4d. − £1250 = £416 13s. 4d.

£4 : £416⅔ } :: 1 year : time
£1250 : £100 }

$$\frac{1\text{ yr.}\times1250\times100}{3\times4\times1250}=8\tfrac{1}{3}\text{ yrs. Ans.}$$

2. If a man can walk a certain distance in 32·5 days, walking 11·97 hours a day, how long will it take him to walk half that distance, walking 11·4 hours a day?

11·4 ho. : 11·97 ho. :: 16·25 days : time

$$\frac{16\cdot25\text{ days}\times11\cdot97}{11\cdot4}=\frac{194\cdot5125}{11\cdot4}=17\tfrac{1}{8}\text{ days. Ans.}$$

3. The 1st, 3rd, and 4th terms of a proportion are 3 cwt. 14 lbs., £1 7s. 1d., and £5 1s. 10d. respectively. Find the 2nd term.

3 cwts. 14 lbs. : ? :: £1 7s. 1d. : £5 1s. 10d.
or or or
350 lbs. : ? :: 325d. : 1222d.

$$\text{2nd term} = \frac{350 \text{ lbs.} \times 1222}{325} = 1316 \text{ lbs.} = \underline{11 \text{ cwt. } 3 \text{ qr.}} \text{ Ans.}$$

Grammar.

'Sweet are the uses of adversity,
Which like the toad, ugly and venomous,
Wears yet a precious jewel in his head,
And this our life exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything.'—*As You Like It.*

(*a*) Point out the adjective sentence in the above and analyse it.

(*b*) The adjective sentence is generally attached to the word in the principal sentence which it qualifies by a relative pronoun. Is it ever so attached by any other kind of word? If it is, give an example.

(*c*) Parse all the pronouns in the above passage.

(*d*) Give the meaning of the passage in plain, simple words of your own.

(*a*) The adjective sentence is, '*Which like.....wears yet a precious jewel in his head.*'

(1) Which .....simple subject
(2) like the toad, ugly and venomous...enlargement of subject
(3) Wears .....predicate
(4) a jewel .....simple object
(5) precious .....enlargement of object
(6) in his head .....extension of predicate (place)
(7) Yet .....extension of predicate (concession)

(*b*) The adjective sentence is sometimes attached to the word in the principal sentence by a conjunctive-adverb, as, I got the book in the place *where* you left it.

(*c*) *Which*—simple rel. pron., referring to 'adversity,' 3rd pers., sing., neut., nom., subject of '*wears*.'
his—3rd pers. pron., referring to 'toad,' com., sing., pos., attrib. to '*head*.'
our—1st pers. pron., referring to speakers, com., plur., poss., attrib. to '*life*.'

(*d*) Our banishment from towns has deprived us of many of the conveniences of life, but just as the loathsome toad is said to have a jewel in his head, so our banishment has led us to learn many agreeable lessons from Nature's book.

2. What is the origin and meaning of the word 'case' as applied to nouns and pronouns? Compare it with declension.

Case, derived from Lat. *casus*, a falling, is an inflexion of nouns and pronouns for showing the relation which they bear to other words. The term case is also applied to denote certain grammatical relations of nouns and pronouns, even though these nouns and pronouns have *no distinct forms* to express those relations. There are three cases, the Nominative, the Possessive, and the Objective. The possessive is the only case of nouns that has a distinct 'falling away' from the 'upright line' of the nominative.

Declension is a term applied to the act of going through the cases of nouns, in both numbers, thus:—

Noun.		*Pronoun.*	
Singular.	Plural.	Singular.	Plural.
Nom. Man	Nom. Men	Nom. I	Nom. We
Poss. Man's	Poss. Men's	Poss. Mine	Poss. Ours
Obj. Man	Obj. Men	Obj. Me	Obj. Us.

3. Point out the Celtic or Scandinavian (Danish) element (stating which you believe it to be) in each of the following names:—Aberdeen, Balmoral, Pen-maen-Mawr, Caer-leon, Kilmarnock, Whitby, Caldbeck, Dalby, Mickleforce, Scawfell.

In Aberdeen, *Aber* (the mouth of a river) is Celtic.
„ Balmoral, *Bal* (a village) „ do.
„ Pen-maen-Mawr, *Pen* (a mountain) „ do.
„ Caer-leon, *Caer* (a fort) „ do.
„ Kilmarnock, *Kil* (a chapel) „ do.
„ Whitby, *-by* (a town) „ Danish.
„ Caldbeck, *-beck* (a brook) „ do.
„ Dalby, *Dal* (a vale), *by* (a town) are do.
„ Mickleforce, *-force* (a waterfall) is do.
„ Scawfell, *-fell* (a rock-hill) „ do.

Geography.

1. Draw an outline map of the Atlantic Ocean, and insert the lines of latitude and longitude.

2. Give full notes of a lesson on 'Central America.'

N.B.—*Do not waste time on introduction.*

NOTES OF A LESSON ON CENTRAL AMERICA.

Description and Situation.—Central America consists of a long, narrow, and irregular strip stretching from Mexico to the narrowest part of the Isthmus of Panama.

Size.—About 900 miles long, and from 70 to 350 miles broad.

Physical Features.—The mountains of three groups—the Honduras and Nicaragua group, the Costa Rica group, and the Guatemala group; some volcanoes in latter. Centre of country a lofty table-land, with a temperate climate; the coast low, hot, and unhealthy. Rivers of little consequence. The soil is very fertile.

Products.—Indigo, cochineal, mahogany, dye-woods, sugar, and cotton.

The chief industries are agriculture, mining, and cutting mahogany and other woods for exportation.

Divisions.—Guatemala, San Salvador, Honduras, Nicaragua, and Mosquito Coast, Costa Rica, and British Honduras. *Towns.*—New Guatemala, San Salvador, Leon, San José, and Belize.

Population.—Nearly three millions, consisting of Indians, Spaniards, and a mixed race.

Government.—Except in British Honduras—a British colony—the form of Government is republican, each of the five states being independent.

Religion.—Roman Catholic; other Churches tolerated.

Map should be drawn on blackboard.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What events make the years 1172 and 1282 memorable in the history of the United Kingdom?

The year 1172 is memorable as being the year in which Ireland was nominally conquered by the English. Strongbow, Earl of Pembroke, Fitzstephen, and Fitzgerald, and latterly Henry II. himself, landed in Ireland. The king received the homage of the Irish Princes at Dublin, and on leaving the island he appointed Prince John to the Lordship of the country.

Llewellyn, Prince of Wales, refused to do homage to Edward I., and for five years the English king traversed the land with foreign troops. Llewellyn held out bravely, but his death from a lance-wound sealed the doom of Welsh independence, 1282.

2. A money-bill is, by the theory of the Constitution, a free grant made by the Commons to the Sovereign. Explain the importance of this principle.

As it is the people who pay the taxes, the representatives of the people in the House of Commons reserve to themselves the exclusive right to originate 'Money Bills' for taxing the people. The Commons, having not only the right to the expenditure of certain items, may oppose the granting of supplies until all grievances are redressed, and all necessary measures are passed for the good government of the people. No grievance of any magnitude could remain unredressed if supplies were refused as long as it existed.

3. It has been said that eight islands as well as thirteen colonies were lost to England by the Ministry of Lord North. Can you show the truth of this statement?

In 1770, on the proposal of Lord North, the Prime Minister, a duty of threepence a pound laid on tea was imposed for the purpose of asserting the right of the mother-country to tax the *thirteen* American Colonies. The taxed tea sent to Boston was thrown overboard by a party of enraged townsmen. This disturbance led to punishment, and the breach widened, till on the 4th of July, 1776, the revolted colonies, under the name of the United States of America, declared themselves independent of Great Britain. Finally, in 1783, Britain acknowledged their independence.

Lord North's administration lasted from 1770 till 1782. In 1772, by the Peace of Paris, Martinique, Cuba, and the Philippine Islands, were given up, the first to France, and the others to Spain. In 1783 Minorca was restored to Spain by the Treaty of Versailles.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Incompatibility*.

Write, in small hand, as a specimen of copy-setting, *A Letter on the Spirit of Patriotism*.

Composition.

Write a short essay on *Cruelty to Animals*.

Cruelty to animals consists in harshly treating either wild or domestic animals. Wild animals, such as game, are hunted by sportsmen, and though we may maintain that such animals were created for our enjoyment, yet we are not at liberty to set snares for them, by which they often die a lingering and painful death. In shooting birds, many a one merely wounded lives, perhaps, a few days, only to succumb. This unintentional cruelty on the hunter's part is cruelty, after all, and cannot be defended or excused. The hunting of the fox, though pursued passionately by the highest people in our country, is but a species of cruelty practised by the nobility, and cannot be defended any more than the hunting of cats by the cruel schoolboy. Pigeon-shooting, in which many of these gentle birds, instead of being killed outright, are merely maimed, and thus suffer excruciating agony, has been much condemned; but so long as ladies of refined feelings look on admiringly at these shooting and slaughtering displays, so long may we expect a continuance of this high-class sport.

Boys have been long notorious for plundering birds' nests, destroying young birds, torturing cats and other of the lower animals; and even men, who make use of poor old hacks for what is called horse-work, have to be watched in this most enlightened nation by officers of the Society for the Prevention of Cruelty to Animals.

Algebra.

MALES.

1. Simplify:—

(1) $$\frac{a+b+\frac{b^2}{a}}{a+b+\frac{a^2}{b}} = \frac{a^2+ab+b^2}{a} \div \frac{ab+b^2+a^2}{b}$$

$$= \frac{(a^2+ab+b^2)\times b}{a \times (ab+b^2+a^2)}$$

$$= \frac{b}{a} \quad \text{Ans.}$$

(2) $$\frac{ac+by+ay+bc}{af+2bx+2ax+bf} = \frac{ac+bc+ay+by}{af+bf+2ax+2bx}$$

$$= \frac{(c+y)(a+b)}{(f+2x)(a+b)}$$

$$= \frac{c+y}{2x+f} \quad \text{Ans.}$$

2. Find the square root of $36x^4-36x^3+17x^2-4x+\frac{4}{9}$.

$6x^2$ | $36x^4-36x^3+17x^2-4x+\frac{4}{9}$ ($6x^2-3x+\frac{2}{3}$ Ans.
$36x^4$

$12x^2-3x$ | $-36x^3+17x^2$
$-36x^3+9x^2$

$12x^2-6x+\frac{2}{3}$ | $8x^2-4x+\frac{4}{9}$
$8x^2-4x+\frac{4}{9}$

3. Solve the equations:—

(1) $ax-by=a^2$ or $abx-b^2y=a^2b$
$bx-ay=b^2$ or $abx-a^2y=ab^2$
by subtraction $y(a^2-b^2)=ab(a-b)$
$\therefore \quad y=\frac{ab}{a+b}$ Ans.

by substitution $x=\frac{a^2+ab+b^2}{a+b}$ Ans.

(2) $780x-73x+1=0$
factorizing $(60x-1)(13x-1)=0$
$\therefore \quad 60x=1$
$x=\frac{1}{60}$
or $13x=1 \therefore x=\frac{1}{13}$

Euclid.

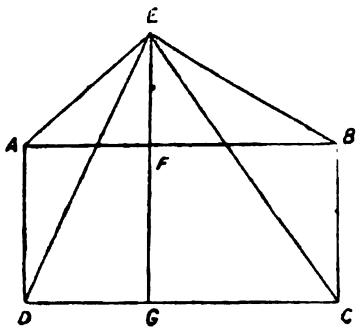
MALES.

Answer two questions, including (if possible) Q. 1.

[All generally understood abbreviations for *words* may be used.]

1. ABCD is a rectangle, E any point. Show that the squares on EA, EC are together equal to the squares on EB, ED.

From E let fall the perpendicular EFG, meeting AB in F, and DC in G. Then AF = DG, and BF = CG.



Now sq. on AE = sqs. on AF (DG) and EF.
and sq. on EC = sqs. on EG and GC.
that is, sqs. on AE and EC = sqs. on DG, EF, EG and GC.
Again sq. on EB = sqs. on EF and BF (GC)
and sq. on ED = sqs. on EG and DG.
that is, sqs. on EB and ED = DG, EF, EG and GC, but the sqs. on AE and EC were equal to the same four squares; therefore the sqs. on AE and EC = sqs. on EB, ED. Q. E. D.

2. If a straight line be divided into any two parts, the squares on the whole line and on one of the parts are equal to twice the rectangle contained by the whole and that part, together with the square on the other part.

Prop. 7, Bk. II.

3. In every triangle, the square on the side subtending either of the acute angles is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides, and the straight line intercepted between the acute angle and the perpendicular let fall upon it from the opposite angle.

Prop. 13, Bk. II.

Mensuration.

MALES.

1. A triangular field (whose sides are 350, 440, 750 yards) is let for £26 5s. a year; what is the rent per acre?

Half perimeter $= \frac{350+440+750}{2} = 770$ yds.

Area $= \sqrt{770\times(770-350)\times(770-440)\times(770-750)}$
$= \sqrt{770\times420\times330\times20}$
$= \sqrt{21344400000}$ sq. yds.
$=$ 46200 sq. yds.
46200 sq. yds. : 4840 sq. yds. :: £26 5s. : rent
$\frac{£26\ 5s. \times 4840}{40200} = £2\ 15s.$ per ac. Ans.

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Publications Reviewed.

The Food we Eat: Why we Eat it, and Whence it Comes. By J. Milner Fothergill, M.D. Griffith and Farran's Household Hand-books.

This is one of a series of manuals issued by Griffith and Farran, and entitled Household Hand-books. The general get-up of the book leaves nothing to be desired. It is well printed in a large type, the cover is elegant, and the binding good.

Everything written by Dr. Fothergill, a most prolific writer, is readable and instructive; but he suffers like many other authors from over-writing; and the book before us bears evidence of hasty composition, in its irregular marshalling of facts. Most of the chapters of this book originally appeared in the *Burlington Magazine*.

The first chapter on 'Why do we Eat?' is a rambling, chatty, and occasionally witty discourse on the social aspects of eating. We are treated among other answers to this question, to that of the young lady who says:—'What an absurd question to ask! Why, because mamma would send for the doctor if we didn't, and he would send some nasty tonic!' and to that of the sophisticated damsel, who exclaims—'It is so awfully jolly! oysters, game, and champagne with my dear Charlie. I could dance till doomsday!'

Such sketches, although possibly very appropriate in a fashionable magazine, seem somewhat out of place in a Household Hand-book. In fact, there is far too much concealment of useful information by sketches and disquisitions on irrelevant subjects. Thus in the succeeding chapter we have a detailed explanation, very ably worked out, of the reasons why a patrician gets gout on the slightest provocation, while an alderman usually escapes, however much he indulges.

In the fourth chapter our author describes honey as the only animal sugar we know of; but in a foot-note the editor says this is an erroneous expression, honey being a vegetable product stored up by the bees. This is not the only instance of the editor mildly taking Dr. Fothergill to task. In a later chapter our author makes the somewhat astounding and strikingly original assertion, that if Cain had not eaten Abel's sheep, we should still have been in the garden of Eden, and 'free from the Nemesis of the cook's art, the painful Podagra!' The editor gently suggests that the hypothesis that Cain killed Abel in a fit of gouty irascibility is not substantiated by the Hebrew record!

The later chapters of this work are much superior to the earlier, though the author's exuberant style and tendency to extravagances is irrepressible. The chapter on Fish is very good. We may echo Dr. Fothergill's exclamation, 'Verily indeed the inhabitants of the salt sea are numerous and toothsome!'

The chapters on 'Nursery Food' and 'Invalids' Food' are most excellent, and the book is well worth buying if only for these two chapters.

The chapter 'on the diet of A.D. 2000 is bold in conception. It will serve at any rate as a protest against the development of brain, at the expense of stomach and every other organ, which is rapidly becoming a serious matter.

We cannot recommend the book for use as a text-book in schools, or as a Household Hand-book. But it is an extremely readable book, which can be easily perused at odd intervals, and combines much amusement with abundant valuable hints and information.

Our Little Ones. September, 1882. London: Griffith and Farran.

In all respects this magazine maintains its high character.

Sectional Paper. London: Griffith and Farran.

Teachers of sewing will thank Messrs. Griffith and Farran for this cheap new quarter inch Sectiona Paper. It is indispensable for teaching cutting out in classes, and ought to be used by every mistress.

The Reciter. Edited by A. H. Miles. London: Caudwell, Old Bailey, E.C.

This new venture deserves to succeed; it is wonderfully cheap, and contains judicious selections from some

of the best authors, dead and living. We especially commend Mr. Miles' Reciter to the notice of those teachers who contemplate giving entertainments during the coming winter.

Ledsham's Short Stories Cards. London: Simpkin and Co.

Every one who has had any experience as a teacher in an Elementary School knows how difficult it is to get the children in the upper standards to express themselves in fairly good English. These cards should do much to remove the difficulty. Cautions, explanations of words, and a paraphrase, accompany each story. We hope this modest-looking packet of cards will find its way into many schools, both at home and abroad.

My First Algebra. By M. H. Senior. London: Simpkin, Marshall and Co. Manchester: Greenwell.

This little introduction to Algebra up to Fractions is neat, clear, concise, yet thoroughly explanatory withal. It differs favourably from a host of so-called easy Algebras, which might be more correctly termed the Difficulties of Algebra Evaded. The clearness and simplicity of this little introduction will fully recommend it, together with the neatness of its printing and arrangement. It extends to factors and exercises preparatory to simple equations; quite far enough, we think, for first steps. In this we know we differ from many who advocate the early acquaintance with the doctrine of equations. But we question whether much satisfactory progress can be made by doing a few easy examples—pretty as they may be—without a good foundation in factors, and a fair mastery of the elementary rules. The method in which factors are treated by Mr. Senior is most commendable. By mastering these well-graduated preliminary lessons boys will have no difficulty in dealing with fractions, which we hope to see treated by Mr. Senior in the same lucid manner. The answers are put at the end according to the usual practice, whereby results may not be seen too easily.

Stories for Children from English History: For Standard III. of the New Code. London: Cassell, Petter, and Galpin.

The New Code arrangements, requiring reading books to be graduated and definite in design, is already producing a plentiful crop of new reading books. The one before us has the merits of being well got up, and written in a style most suitable for the class of intended readers. The lessons are arranged in most cases under biographical headings, and give interesting pictures of the different periods in which the historical personages figured. We need scarcely say that the events of each period or 'reign' are limited to the most striking occurrences. These are told generally with power and skill, and with remarkable fairness. We have in the chapter on Oliver Cromwell no absurd tirades against the leader of the Commonwealth, nor bitter revilings against Charles and the Royalists. With these general sketches young readers will be interested in their country, and desirous for further reading on the subject. This, we take it, is the proper course for introductory lessons in which minute information is undesirable. The book will do good educational service.

Marshall's English History Readers. Book II.—Early England. John Marshall and Co., 42, Paternoster Row.

To judge by the number of reading books on almost every subject, but especially on English History, the demand for such must be practically unlimited. The book before us has the merits of being well and simply written, and nicely illustrated and printed. It embraces the period known as Early England, and in this is included our history up to the death of Stephen and the succession of Henry II. There is little to criticise or to find fault with; the characters being treated with remarkable fairness. The writer is clearly convinced of the success of Dr. Freeman's attempt to teach even children to recognise the difference between what is true and what is legendary in history.

The story of Alfred is very charmingly told, and it is a pity that that prettiest of tales about his learning to read cannot possibly be true. That Alfred was a man of some education, great talents, and, best of all, of great nobility of character, no one would think of denying. But the story of Alfred's mother offering the beautiful book as a prize to her children, pretty as it is, must be relegated to the class of legends. Now Alfred was born in the year 849, and we are told that up to the age of twelve—*i.e.*, the year 861—he could not read. But his mother Osburga, and his father Ethelwulf, were both dead at this time; therefore it could not have been Osburga who offered the book to her children. But this is not all: by the year 861 Alfred's brothers were no longer children, but grown-up men, and two of them were already dead. To remove all doubt on the subject, however, Alfred had paid a visit to Rome before he was five, and his father had married his second wife Judith in the year 856, *i.e.*, when Alfred was about seven years old. And it is hardly a matter for surprise that Alfred was unable to read before he was seven.

The character of William the Conqueror is carefully dealt with, and the result is that we have a truthful portrait, freed from prejudice either in his favour or against him. One of the greatest marks of his statesmanship is omitted in this book. He at once recognised the necessity of reigning as king of the nation, and not merely as feudal lord. Therefore he caused the famous oath at Salisbury to be taken, by which *all* feudal tenants were bound to him by oath of allegiance. In conclusion, we must say that we are glad to meet with a reading book written so sensibly and in such excellent style as this. The English is simple and picturesque, and no pains have been spared by the writer to produce a really interesting and useful book.

Outline of the History of the English Language and Literature. London and Edinburgh: W. and R. Chambers.

This little manual is got up with the care and finish that mark the printing and binding of Messrs. Chambers' publications. It will be a valuable addition to our grammatical literature, and be an incentive to more extended reading. It is no mere compilation, but marked by originality and careful investigation throughout. In enumerating the sources of our present English, the author scarcely does justice to the number of Celtic (or Keltic we suppose we must follow the author in using) words that yet form a great portion of our common speech. Notwithstanding the incessant changes which our language has continually undergone, there are many hundreds of the words spoken by the Britons yet in common use. Doubtless the Norman French supplied very many of our common words, which the Welsh also borrowed, or had at least cognate forms, as *beer*, which was in Norman French *biere*, and in Welsh, *bir;* English *pear*, Teutonic or Norman French, *pera*, and Welsh, *per*—all pronounced nearly alike; and our English *one* is pronounced really more like the Welsh *un* than the Anglo-Saxon *aen*.

The west-country folk adhere to *un* in preference to *it*. 'Pick *un* up, bring *un* here,' etc. Now when we can point to numbers of such undeniably British words as *bacon*, *banner*, *barb*, *balderdash*, *bard*, *barley*, *barrel*, *base*, *basin*, *basket*—and here we must stop in the mere beginning of b's—surely more may be said of our indebtedness to Keltic sources. The author shows in regard to several late acquisitions that the spirit of our tongue in regard to

acquisitiveness is still active. All is grist that comes to our mill in the way of suitable and expressive words. All contributes to the force and fulness of a language destined, according to Grimm, to become 'the language of the universe.' To see clearly how this process has gone on, and how obsolete and cumbrous forms have been abandoned, which this book ably helps to point out, is well worthy the attention of young students.

A School Course of Heat. By W. Larden, M.A. London: Sampson Low and Co.

This most valuable compendium of experimental physics on the important subject of HEAT cannot fail, we think, of becoming a standard text book. It professedly deals with the demonstrations of formulæ, and the explanations of apparatus. The former of these comprise arithmetical examples in each case, supplemented by algebraical expressions. The latter comprise full descriptions, together with well-executed engravings of the most approved apparatus suitable for experimental proof or illustration. Although professing to avoid disputed theories, or those beyond the powers of ordinary students, explanations are in no wise wanting, and clearly given. The student is led by this treatise to take nothing for granted, but verify phenomena by experimental proof. We need scarcely say that this is true science as now understood, but it is also true that much science teaching is mixed up with improved assertions and speculative theories. Science is not identified with *what may be*, but *what is*, and this truth Mr. Larden carries out in the well-arranged book before us. The questions, mostly comprising arithmetical proof, are numerous, varied, and suitable. The explanations of ordinary phenomena will also be read with interest by others beside the regular student, as the following on CLOUDS and MISTS:—'True vapour is invisible. When this is condensed, it in general forms drops of water. If these drops are large they fall as rain, being heavier than the air. But the drops of water of which clouds are composed are small, and fall very slowly through the air, owing to its viscosity. Every cloud in still air is falling, but its slow fall is disguised by other and greater movements. A cloud then is not a true vapour, but a collection of matter, particles of water slowly falling as fine dust through the air.' In order to save space we have not quoted quite literally, but sufficiently as not to misrepresent the author's meaning. We simply regret that we have not space to quote much more of the writer's remarks on this *cloudy* subject, which he treats far from cloudily. Much more we would willingly quote, but we must, for the present at least, be satisfied with cordially praising this book.

Notes of Lessons on English Grammar for the Use of Teachers in Elementary Schools. By J. E. Singleton. London: Jarrold and Sons.

We are much pleased with this book, and believe it will be acceptable to teachers of all classes. The author has moved on the lines laid down by the Code at present in operation, and has wisely limited the early lessons for the younger pupils to the points required by the Code. Further details on each 'Part of Speech' are judiciously deferred to subsequent chapters or lessons. This we take to be conforming to the spirit of the Code as well as to its letter, and is also the proper method of dealing with grammar. This subject has perhaps suffered more than any other from exhaustive modes of treatment. In arithmetic, for instance, very easy sums are given for beginners, who are not bewildered with the demonstrative part of the science which unwise pedants would introduce. We are aware that there are 'Grammars for Beginners,' some of which are very meritorious, but in general too much is attempted on each branch of the subject in the early stages. Mr. Singleton avoids this error, and has an evident sympathy for children, in the painstaking efforts he makes to clear away difficulties and explain every step. In regard to the first steps, we have nouns developed by four lessons up to the distinctions of common, proper, and abstract. Verbs are similarly handled in three lessons, which include simple, auxiliary, and compound verbs. This will fairly suffice for the introduction to grammar required by the New Code for Standard II. We are particular in mentioning this, on account of complaints of grammar being too difficult for the early standards. With Mr. Singleton's help there need be no such objections to the teaching of this subject. The first eight lessons carefully taught and recapitulated will qualify the pupils of Standard II. to pass with ease and credit.

The book is well printed, in separate columns on each page; one of these columns comprises explanatory 'steps,' under the heading of METHOD. The other column, under ILLUSTRATIONS, contains special directions to the teacher. In some cases we fail to see the necessity for the second column, but in all cheerfully recognize the clearness, completeness, and soundness of the lessons. The first chapter treats of the classification of words, the second of their inflections, the third of parsing, the fourth of analysis, and the fifth—too briefly, we think—of the formation of words for the requirements of the Fourth Standard. In the Appendix we have our principal English prefixes given under the heading SAXON PREFIXES. It is something to get rid of the term *Anglo-Saxon*, but why not call this early form of our speech by the term *Old English?* We may expect to see in a second edition affixes also given, together with a few pages of derivations, so as to render this book not only eminently useful but thoroughly complete.

Science Notes.

PREVALENCE OF THE SALMON DISEASE.—The Tweed Commissioners give in their report a very gloomy account as to the ravages caused by the fungus parasite among the salmon. The past season has been marked by the unexampled severity with which the fish have been attacked. Last year the diminishing number of dead and dying fish taken from the Tweed led them to hope that the epidemic was in a fair way to disappear, but their expectation has unfortunately not been realized. This year the bailiffs have removed from the stream 14,627 dead or dying fish; in 1880 the number was 5,222, while last year it only reached 2,907. Of the large number so taken from the water in 1882, only 55 were not affected by the fungus. The disease is due to the growth of a species of *Saprolegnia*, akin to that which is frequently observed towards the end of the year clothing with its white threads so many dead flies.

* * * * *

FISH DISEASE IN THE RIVER VISTULA.—A mortality, which in its extent is comparable to the ravages of the *Saprolegnia* among the salmon, is reported in the *Voss'che Zeitung*. It has been noticed chiefly in the neighbourhood of Dantzig, where large masses of fish in an exhausted condition, half dead, have been found floating on the surface of the stream. In this case, however, it is no parasite that has caused the mischief, but this has been traced to the

pollution of the river by refuse from manufacturing establishments in its neighbourhood. Prominent among the sufferers are numbers of pike of large dimensions.

* * * * *

PREVENTION OF RIVER POLLUTION.—The Vistula outbreak makes those interested in fish culture turn their attention to the possibility of averting the pollution caused by manufacturing establishments. One of the chief manufactures which cause it is that of the finer class of paper, the chloride of lime which is used in the bleaching being the chief agent in the matter. It is possible now, in consequence of some very delicate tests invented by Mr. A. Nesbit, to detect the presence of as little as one two-hundredth part of a grain of commercial bleaching powder in a gallon of water, and to do this without any concentration of the liquid, just as it is raised from the stream. Now one to two grains per gallon are necessary to cause discomfort to the fish. Exposure to the air of the paper waste, diluted till it contains four grains of the chloride to the gallon, causes the deleterious properties to pass away in about four days. It is suggested that the paper-waste should be run into tanks and diluted about to the above extent before being allowed to flow into the stream. After being in these tanks for a few days it will not, on escaping, render the stream noxious to the fish. By this means it is hoped that the two conflicting interests of the fish and the manufacturers may be reconciled.

* * * * *

A POSSIBLE RIVAL TO SUGAR.—Among the many investigations in organic chemistry which have recently been carried out, one of the most interesting is that of Dr. Constantine Falberg. The body he has discovered he terms Anhydro-sulphamin-benzoic-acid. It is a white crystalline substance, very soluble in alcohol, but more sparingly so in water; its chief peculiarity being that it possesses a sweetness twenty or thirty times that of cane sugar. It is so powerful that the merest trace of its alcoholic solution in water gives a distinctly sweet taste to the liquid.

* * * * *

A NEW AMERICAN INDUSTRY.—A process is described from New York by which sugar can be manufactured from corn. It is attracting considerable attention in the Western States of America, where the question of transport of this produce is a serious consideration. The inventor claims that from each bushel of corn forty pounds of sugar can be manufactured. As the yield of corn is very large in the exceedingly fertile soil of those states, the importance of the discovery is great, should it eventually prove to be as satisfactory as at present seems probable. A company has been formed at Rochester, New York State, to work the process, and a sort of branch will be started in California.

* * * * *

FERTILITY OF OATS.—It is reported from North Nottinghamshire that on the farm of Mr. Foljambe, M.P., at Osberton, a stalk of oats has been gathered, the grains of which when counted were found to number no less than 634. The seed which has yielded such a remarkable result is of a specially prolific kind, which Mr. Foljambe's agent introduced from Yorkshire.

* * * * *

NEW APPLICATION OF THE MICROPHONE.—M. Serra Carpi has described, in a paper read before the Academy of Sciences of Paris, a new application of the microphone, to determine the position of the nodes and loops in columns of vibrating air. The microphone is mounted on an elastic membrane stretched over a little drum, and then into the sounding pipe. When the apparatus reaches a node, the telephone which is in circuit with the microphone, gives out, a rumbling sound similar to that caused by an induced current. On the other hand, when the microphone passes a loop, the sounds become very faint and rare, while at intermediate points they increase or diminish according as the microphone is nearer a node or loop. It is believed that the microphone may be made use of in this way in order to detect the presence and position of fire-damp in mines.

* * * * *

A RIVAL TO DYNAMITE.—A new explosive compound has been invented by Mr. E. Turpin, which is less liable to spontaneous combustion than dynamite, and is at the same time more powerful. It is composed of two liquids, both of which are quite harmless before being mixed. The name given to it is Panclastite.

* * * * *

REVIVAL OF SKATING RINKS.—Mr. J. D. Digby, at a recent meeting of the National Skating Association, of which he is secretary, drew attention to a new material for the construction of skating surfaces, the merits of which include the fact that it is a true substitute for ice, so that ordinary skates can be used upon it. He has had a small rink laid, and on trial of the surface he finds it to possess the two qualities needed for skating. When the surface by use has become rough, it can be refaced by a simple and inexpensive process. The cost of artificially producing ice for rink purposes is so great as to make it useless to do it on any large scale, but the new material can be laid for 20s. per square yard. Another advantage connected with it is that it may be laid either in a building or in the open air, as it is not affected by weather; moreover, after being used as a rink, the material will still have a marketable value. The patent is one

of Dr. McLeod's, and it is now proposed to form a company to acquire it, and to take up the manufacture of the material, to establish rinks, and to let out concessions for its use in different towns.

* * * * *

DANGERS OF ELECTRIC LIGHTING AVOIDED.—M. H. Geoffroy has brought before the Academy of Sciences of Paris a specimen of wire, clothed with asbestos and threaded through a leaden pipe, for the prevention of fires where electricity is employed for lighting. In an experiment tried by the engineer to the Faure Accumulator Co., the efficiency of the arrangement was proved by passing such a current through it that the wire, which was of copper, was completely volatilized, while the leaden pipe was not affected in the least.

* * * * *

NEW SOURCE OF CHEESE.—A German paper says that cheese is being made in Thuringia and Saxony from the pulp of boiled potatoes mixed with sour milk. The article so made has these advantages over cheese made in the ordinary way, that it does not engender worms, and keeps fresh for a number of years, provided that it is kept in a dry situation and in well-closed vessels.

* * * * *

THE CONGO EXPLORATION.—Mr. Stanley, who has for the past two or three years been at work upon the Congo, is expected to return to Europe very shortly. He has succeeded in many of the objects for which he has been striving; has erected four factories on ground which has been formally ceded to him by the native kings, and has made a road past the cataracts. M. A. Brazza proposes to construct a railway from the coast to Stanley Pool.

Publications Received.

Algebra—
(1) Senior's My First Algebra. Greenwell.

Arithmetic—
(1) Longmans' Arithmetic, Standards V., VI., and VII. Longmans.
(2) Answers to Arithmetic, Standards I. to VII. Longmans.

English Literature—
(1) Outline of English Language and Literature. W. and R. Chambers.
(2) Stories on Cards. J. B. Ledsham.
(3) Lady of the Lake, Canto II. W. and R. Chambers.
(4) Macaulay's Armada. W. and R. Chambers.
(5) Coleridge's Ancient Mariner. W. and. R. Chambers.

English Language—
(1) How to Write English, English Composition. Houghton.

English Grammar—
(1) Wright's English Grammar. Parts II. to VII., and complete. J. Heywood.
(2) Notes of Lessons on English Grammar. Jarrold and Sons.

History—
(1) Cassell's Historical Readers, Standard III. Cassell, Petter, and Galpin.
(2) Livesey's Notable Events in English History. Burns and Oaks.
(3) Blackie's Historical Readers, Standards II., III., and IV. Blackie and Son.
(4) Girling's Outlines of the History of England. Blackie and Son.

Miscellaneous—
(1) Dawson's Story of Earth and Man. Hodder and Stoughton.
(2) Sectional Paper for Cutting Out. Griffith and Farran.
(3) Facts to Impress: Fancies to Delight. Partridge and Co.

Periodical Literature—
(1) Sports and Pastimes. VI. Cassell, Petter, and Galpin.
(2) Universal Instructor. XIII. Ward, Lock, and Co.
(3) Household Edition of Arabian Nights. Ward, Lock, and Co.
(4) Competitor. T. Fisher Unwin.
(5) Our Little Ones. Griffith and Farran.
(6) The Reciter. G. Cauldwell.

Poetry—
(1) Babcock's Lays from Over Sea. Stewart and Co.

Reading Books—
(1) Longmans' Fifth Illustrated Reader. Longmans.

Writing—
(1) Longmans' Modern Copy-Books. Nos. 7 to 12. Longmans.

THE RT. HON. H. FAWCETT, M.P., ON EDUCATION.—The Postmaster-General, in distributing the prizes last month at the Grocers' Company's Schools, said that he was one of those who gave a somewhat wide interpretation to education—attaching little value to the greatest intellectual success if it were not accompanied with a corresponding development of other qualities, or if the most precious of all gifts, a sound body, was sacrificed. Intellectual and physical development should go hand in hand, helping each other, and the man was not to be congratulated who found that he had attained intellectual success at the purchase of his physical health. He thought it was a great mistake to estimate knowledge simply by the practical or pecuniary use to which it can be turned in after-life. At school and college he studied mathematics more than any other subject, but since that time the circumstances of his life had been such that he believed few people had devoted less attention to mathematics than he had in after-life. Yet, if he could see his time over again, he would not devote less time to this subject, because, though he had not been in a position to practically apply the science, he felt the benefit of this mathematical training every day of his life. He had no hesitation in saying that, whatever a man's life might be, if he had acquired the knowledge of some natural or physical science he possessed an inexhaustible source of the purest enjoyment in life. It was only the other day he was speaking to a gentleman who holds an official position in the department with which he (the speaker) was connected, and he found this gentleman was an enthusiastic botanist, and a great lover of natural history. Of course, he never had an opportunity of using his knowledge of botany in the official work of the Post-office; but having this intellectual recreation outside his official life, instead of interfering with official work, he would venture to assert that it made this gentleman a better official. Considering the struggle for life, it was most important that the practical side of education should not be lost sight of. He thought that at school there was a happy blending of the theoretical and practical in education. He was glad to notice that shorthand was among the subjects taught. Nothing had struck him more than the numerous applications made for clerkships or posts of private secretary, and yet few of these applicants were found to write shorthand. There was scarcely a pursuit of a commercial kind in which shorthand was not of the greatest utility.

Query Column.

☞ **As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'**

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

General.

1. GLADIOLA.—*Stock* may be defined to be the capital of trading companies; or to be the money borrowed by our or any other Government, at so much per cent., to defray the expenses of the nation. From a variety of causes prices of stock continually change.

Shares are originally fixed at a certain price, and then according to the success or failure of the company, and the probable amount of dividend it will pay, the value of the shares fluctuates. Purchases or sales of stock are generally made through brokers, who charge £⅛, or 2s. 6d., per cent. upon the stock bought or sold. So that in practice, when stock is bought by any party, every £100 stock costs that party £⅛ more than the market-price of the stock; and when stock is sold, the seller gets £⅛ less for every £100 stock sold than the market-price. This charge is called *brokerage* or *commission*.

The number or quantity which is produced by reckoning a certain rate per cent. upon any given number or quantity is called the *percentage*.

2. KATHIE.—'Let my gaze be fixed on something.'

Let—Verb, irreg., trans. act., imper., pres. indef., sing., 2nd., agreeing with its subject 'thou' (understood).
my—Pro., per., 1st., com., sing., poss. case, governed by the noun 'gaze.'
gaze—Noun, abs., neut., sing., obj. by the verb 'let.'
be fixed—Verb, reg., trans. pass., infin. mood, indef. tense, and governed by the verb 'let.'
on—Prep., gov. the noun 'something,' and relating the verb 'be fixed' to 'something.'
something—Noun, com., neut., sing., obj. by the prep. 'on.'

3. BEDOUIN.—You will find the solution of your query in our issue for May.

4. P. A., Leeds.—

'There be some sports are painful; but their labour
Delight in them sets off.'

labour—noun, abs., neut., sing., obj. by the verb 'sets off.'
delight—noun, abs., neut., sing., nom. to the verb 'sets off.'
sets off—prepositional verb, irreg., trans., act., indic., pres. indef., sing., 3rd., agreeing with its subject, 'delight.'

5. ROMULUS.—P. Huxley. A. L. and H. Tyndall and Guthrie.

6. F. S. BURTON.—Consult any ordinary School Geography.

7. A READER.—If you mean for an English certificate, No; but any examination you have passed in England would be helpful to an Australian certificate. Write to the agent of one of the Australian Colonies, Victoria Street, Westminster, S.W.

8. RALPHO, St. Vigeans.—(1) No. Elementary branch not recognised. (2) Impossible to give information on subject. Kept secret.

9. EGYPTIAN.—Near its source.

10. LBARWOSWONN.—(1) We think under the 'New,' but you had better consult your Inspector. (2) Royal.

11. NOMEN.—Apply to Secretary of Education Department for Syllabus.

12. CISSIE.—Each Inspector sets his own questions. They are sent to us by the courtesy of teachers. An excellent selection of Grammatical and Geographical Questions, with full answers, will be found in *Hughes's* 'Handbook of Examination Questions,' price 5s., post free.

13. SWANTON.—Purely Elementary.

14. LOUIE.—Music, *Sutton*; Cookery, *Gothard*, 2s. 6d. For origin of words in Macbeth, and Cutting Out, see present volume of *Governess*. Messrs. Griffith and Farran publish a capital little handbook on Plain Cutting Out.

15. LEHRER, Aberdeen.—Soon after the accession of Henry IV. to the throne vacated by Richard II., those peers who had appealed against the Duke of Gloucester, and had been mainly instrumental in his murder, were summoned to exculpate themselves. This they did by alleging their actions to have received the sanction of Richard II. and his Parliament. After a tumultuous hearing, during which forty gauntlets were thrown on the ground as challenges to combat, Henry IV. decided to divest the '*Lords Appellant*,' as they were called, of the titles which Richard had bestowed on them as rewards, and the *Dukes* of Albemarle, Surrey, and Exeter, the *Marquis* of Dorset, and the *Earl* of Gloucester, accordingly became once more the *Earls* of Rutland, Kent, Huntingdon, and Somerset, and *Lord* Le Despencer.

16. PRECEPTOR.—'English Grammar,' *Mason's*, 3s. 6d. (Bell and Sons); or *Tidmarsh's* 'Practical English Grammar,' 2s. 6d. (Rivingtons). 'English Composition,' *Dalgleish's*, 1s., or with advanced 'Text Book,' 2s. 6d. (Oliver and Boyd); or *Johnston's* 'Civil Service Essay and Composition Writing,' 3s. 6d. (Longmans); *Roget's* 'Thesaurus of English Words,' 10s. 6d. (Longmans); or *Smith's* 'Synonyms and Antonyms,' 5s. (Bohn).

17. DUWINYDD.—Your question is of a class not often sent to us. It should have been forwarded to a religious paper. We

may add, however, that justification by faith has its foundation in the teaching of St. Paul and St. James, and is constantly referred to in their writings.

18. DOMINICA.—The term *Paladin* was derived originally from the Counts *Palatine*, or Counts *of the Palace* (from Lat. *Palatium*, a palace), who were the highest dignitaries in the Byzantine and Merovingian Courts, and then used generally for a lord or chieftain.

19. D. T. Z.—(1) C's portion = $\frac{1}{4}$ of $\frac{1}{5}$ of estate + $\frac{1}{4}$ ($\frac{1}{5}$ of estate − £500).
= $\frac{1}{20}$ of estate + $\frac{1}{20}$ of estate − £100.

You must take $\frac{1}{4}$ of the quantity in brackets. Now $\frac{1}{4}$ of $\frac{1}{5}$ of estate = $\frac{1}{20}$ of estate, and $\frac{1}{4}$ of £500 = £100.

(2) The most handy instrument for drawing curved lines for latitude and longitude in an examination, is a piece of round wood or cane bent like a bow by a piece of string,

20. ENQUIRER.—'See, here's a bower of eglantine, with honeysuckles woven.'

See—verb, irreg., trans., act., imper., pres., indef., sing., 2nd, agreeing with its subject 'thou' (understood).
here—adv. of place, mod. the verb 'is.'
is—verb, irreg., intrans., indic., pres., indef., sing., 3rd, agreeing with its subject 'bower.'
a—adj., demons., qual. the noun 'bower.'
bower—noun, com., neut., sing., nom. to the verb 'is.'
of—prep., gov. the noun 'eglantine,' and relating the noun 'bower' to 'eglantine.'
eglantine—noun, com., neut., sing., obj. by the prep. 'of.'
with—prep., gov. the noun 'honeysuckles,' and relating the part. 'woven' to 'honeysuckles.'
honeysuckles—noun, com., neut., plur., obj. by the prep. 'with.'
woven—part., perf., from the verb 'to weave,' trans. pass., qual. the noun 'eglantine.'

21. JONAS ORAGMUS, Wigan.—You must have the segments of the diagonal EB for the solution of your query.

22. S. INGHAM.—Your solution of the deduction is very neat and simple.

23. ARNO.—There is no sense in your query.

24. OMICRON, Sheffield.—You will find the solution of your query in our issue for April.

25. NERO, Pontypridd.—We believe you have copied the question incorrectly. Would you kindly repeat it?

26. ASSISTANT MISTRESS.—We regret to state that owing to the serious illness of the author who undertook to annotate Byron's 'Childe Harold,' that work has not appeared in our pages.

27. UTOR NON ABUTOR.—Ans. Widnes.

28. J. WILDGOOSE.—It is impossible to answer your query, a you do not state which branch of the Civil Service you refer to Get one of the excellent Civil Service Manuals, issued either by Longman, or Crosby Lockwood and Co. You will there find all you want.

Mensuration.

1. MUSE.—A gentleman had a garden 100 feet long and 80 feet wide. A walk was made half way round it, that took up half the ground. Find, without the use of algebra, the uniform width of the walk.

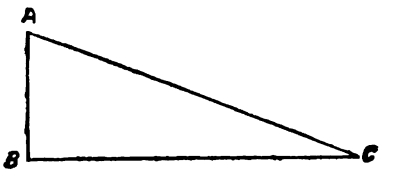
$$\text{Area of walk} = \frac{100 \times 80}{2} \text{ sq. ft.}$$
$$= 4000 \text{ sq. ft.}$$

But area of walk = {100 × width + (80 − width) × width} sq. ft.
= (100 width + 80 width − width²) sq. ft.
= (180 width − width²) sq. ft.

$$\therefore 180 \text{ width} - \text{width}^2 = 4000$$
$$\text{Width}^2 - 180 \text{ width} = -4000$$
$$\text{Width}^2 - 180 \text{ width} + (90)^2 = 8100 - 4000 = 4100$$
$$\text{Width} - 90 = \pm 64{\cdot}031\ldots$$
$$\therefore \text{Width} = 90 \pm 64{\cdot}031\ldots$$
$$= 154{\cdot}031\ldots \text{ or } 25{\cdot}968\ldots$$

It is evident that the value of 154·031 is inapplicable.
∴ Width of walk = 25·968...ft.

2. A BEGINNER IN MATHEMATICS.—One side of a right-angled triangle is 3925 feet; the difference between the hypotenuse and the other side is 625 feet; find the hypotenuse and the other side. (*Todhunter.*)



If AB = 3925, then AC = BC + 625.
$AC^2 = AB^2 + BC^2$, (I. 47.)
$(BC + 625)^2 = (3925)^2 + BC^2$
$BC^2 + 1250\ BC + 390{,}625 = 15{,}405{,}625 + BC^2$
$1250\ BC = 15{,}405{,}625 - 390{,}625$
$1250\ BC = 15{,}015{,}000$
$\therefore BC = 12.012.$

∴ Other side = 12,012 ft., and hypotenuse
= (12,012 + 625) ft. = 12,637 ft.

Note.—(1) There is no rule; the factors are generally found by inspection. It is very useful to notice the following facts:—
$x^n - a^n$ is divisible by $x - a$ whether the index n be an *odd* or *even* whole number.
$x^n - a^n$ is divisible by $x + a$ if the index n be an *even* whole number.
$x^n + a^n$ is divisible by $x + a$ if the index n be an *odd* whole number.
(2) Write to the Secretary of the College. (3) Through any bookseller.

3. BURRA BURRA.—One side of a triangle is half the sum of the two others, the sum of the three sides is 84 yards, and the area of the triangle is 14 square yards. Find the sides. (Pupil Teacher's Examination, *October*, 1880.

Area of triangle = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$, where a, b, c = sides, and s = half sum of sides.

$$a + b + c = 84, \text{ and } b + c = 2a,$$
$$\therefore 3a = 84$$
$$\therefore a = 28, \text{ and } b + c = 56.$$
$$14 = \sqrt{42\,(42-28)\,(42-b)\,(42-c)}$$
$$196 = 42 \times 14\ (42-b)\ \{42-(56-b)\}$$
$$\tfrac{1}{3} = (42-b)\,(b-14)$$
$$= 56b - b^2 - 588$$
$$b^2 - 56b = -588\tfrac{1}{3}$$
$$b^2 - 56b + (28)^2 = 784 - 588\tfrac{1}{3}$$
$$= 195\tfrac{2}{3}$$
$$b - 28 = \pm 13{\cdot}988\ldots$$
$$b = 28 \pm 13{\cdot}988\ldots$$
$$\therefore b = 41{\cdot}988\ldots \text{ or } 14{\cdot}011\ldots$$

∴ Sides of triangle = 28, 14·011... and 41·988 .. yards. Ans.

Arithmetic.

1. ALPHA.—What is the annual interest on £76,978, bought into the Danish 3½ per cents. at 77, and what sum would be gained by selling out at 77⅛? (*Colenso.*)

£	£	£	
77	76,977½	3½	Income
11	6,998	2	

∴ Income = £3,100. Ans.

£ £ £
77 : 78,975 :: 1/8 : Gain
7 6,998
∴ Gain = £(78,975/8 × 1/7)
= £874 15s. Ans.

2. B. O. Y.—12 lbs. of tea and 25 lbs. of coffee together cost £4 6s. 8d.; but if tea were to rise 2½ per cent. and coffee to fall 4½ per cent., the same quantities would cost £4 5s. 11d. Required the prices of tea and coffee per lb.

12 lbs. of tea and 25 lbs. of coffee cost £4 6s. 8d.
12 lbs. of tea at 2½ per cent. increase and 25 lbs. of coffee at 4½ per cent. decrease cost £4 5s. 11d.
∴ Cost of 25 lbs. of coffee at 41/40 of original price
− cost of 12 lbs. of tea at 41/40 of original price
= £4 6s. 8d. − £4 5s. 11d.
= 9d.
∴ Cost of 25 lbs. of coffee at original price − cost of 12 lbs. of tea at (41/40 × 80/82 = 4/5) of original price = (9 × 20/1)d.
∴ Cost of 25 lbs. of coffee − cost of (12 × 4/5) lbs. of tea = 200d.
Cost of 25 lbs. of coffee + cost of 12 lbs. of tea = 1040d.
,, ,, − ,, 6⅘ ,, = 200d.
∴ (By subtraction),
Cost of 18⅘ lbs. of tea = 840d.
∴ Cost of 1 lb. of tea = (840 × 5/94)d.
= 45d.
= 3s. 9d. Ans.
Cost of 25 lbs. of coffee + (45 × 12)d. = 1040d.
Cost of 25 lbs. of coffee = 1040d. − 540d.
= 500d.
∴ Cost of 1 lb. of coffee = 20d.
= 1s. 8d. Ans.

3. O. H. F.—What is the price of the 3 per cent. stock, when after paying 4d. in the pound income-tax, it yields 3½ per cent. interest?

s. d. £ £
19 8 : 3½ :: 1 : percentage with income-tax
3 60
59 210
= £3 3/59.
£ £ £
∴ 3 3/59 : 3 :: 10⅘ : price of stock
59
177
7
= £5 1/2 = £84½. Ans.

4. YELSERP.—The gross receipts of a railway company in a certain year are apportioned as follows: 41 per cent. to pay the working expenses, 56 per cent. to give the shareholders a dividend at the rate of 3½ per cent. on their shares, and the remainder, £15,000, is reserved; find the paid-up capital of the company. (*Barnard Smith.*)

{100 − (41 + 56)} per cent. of the gross receipts = £15,000,
3 per cent. of the gross receipts = £15,000;
∴ amount for dividend = (15,000 × 3/2) £
= £280,000;
∴ capital of company = £280,000 × 100/3½
= £280,000 × 200/7
= £8,000,000. Ans.

5. P. T., Brierley.—A certain field will graze 2 oxen and 3 horses for 21 days, or 3 oxen and 2 horses for 19 2/11 days; compare the appetite of an ox and a horse.

The field will graze 2 oxen and 3 horses for 21 days,
∴ ,, ,, ,, (2 oxen and 3 horses) × 21 for 1 day,
= 42 oxen and 63 horses ,, ,,
,, ,, ,, 3 oxen and 2 horses for 19 2/11 days,
∴ ,, ,, ,, (3 oxen and 2 horses) × 19 2/11 for 1 day,
= 58 2/11 oxen and 39 5/11 horses.
∴ 58 2/11 oxen and 39 5/11 horses eat as much as 42 oxen and 63 horses,
(58 2/11 − 42) oxen eat as much as (63 − 39 5/11) horses,
16 4/11 ,, ,, ,, 23 2/11 horses,
525 ,, ,, ,, 735 horses,
5 ,, ,, ,, 7 horses;
∴ appetite of ox : appetite of horse :: 7 : 5. Ans.

Note.—The solution of your first query appeared in our issue for May. See No. 9 of arithmetical queries.

6. DEVONIAN.—At what rate per cent. will £250 gain £20 8s. in 2 years at compound interest?

Interest on £1 for 2 years = £20·4 ÷ 250
= £·0816;
Amount of £1 ,, ,, = £1·0816.
√1·0816 = 1·04.
∴ amount of £1 for 1 year = £1·04
,, £100 ,, = £104
∴ Rate per cent = 4. Ans.

Note.—(1) When the given time is 3 years, 4 years, etc., the cube root, 4th root, etc., must be taken.

(2) If you refer to our issue for January you will find solution of question to find time at compound interest, as well as to find rate per cent.

7. RESOLVE.—Divide 13s. 1½d. into six parts, each succeeding part to be 6½d. more than the one preceding.

Second part = 6½d. more than first part,
Third ,, = 1s. 1d. ,, ,,
Fourth ,, = 1s. 7½d. ,, ,,
Fifth ,, = 2s. 2d. ,, ,,
Sixth ,, = 2s. 8½d. ,, ,,
∴ First part = {13s. 1½d. − (6½d. + 1s. 1d. + 1s. 7½d. + 2s. 2d. + 2s. 8½d.)} ÷ 6
= (13s. 1½d. − 8s. 1½d.) ÷ 6
= 5s. ÷ 6
= 10d.
∴ Parts = 10d., 1s. 4½d., 1s. 11d., 2s. 5½d., 3s., and 3s. 6½d.

8. W. G. J. C. B.—The first of a line of ten sentries, standing at equal distances from each other, wishes to send a message of twenty words to the last. The men begin to walk at the same instant and walk even distances right and left of their posts, alternately, and each time they meet pass on five words. The transmission of the message occupies 48 minutes, and the men walk at the rate of 3 miles per hour. How far is the first man from the last?

A sentry travels 8½ times his round while a message is transmitted along the whole line;
Between each message he travels twice a round;
∴ Distance travelled by a sentry while the twenty words are conveyed = 8½ + 2 + 2 + 2 = 14½ times a round;
∴ Distance between first and last sentries
= (3 × 4/9 × 9/14½) miles
= (3 × 1760 × 4 × 18 / 5 × 29) yds.
= 2,621 19/29 yds. Ans.

9. J. DAVEY.—A debt is to be discharged at the expiration of 4½ months, ½ is paid immediately, and ½ at the expiration of 3 months; when ought the remainder to be paid?

(½ × time) + {½ × (time − 3)} = 4½, where time is in months;
½ time + ½ time − 3/2 = 4½
3/2 time = 4½ + 3/2
= 5½
∴ time = 5½ × 2/3
= 7 months. Ans.

Algebra.

1. FOLKESTONIAN.—Each of two bags contains 228 coins, sovereigns and shillings only; one contains as many sovereigns as the other shillings, and its contents are worth twice as much as those of the other; find the number of shillings in each. (*Certificate Examination.*)

Let x = no. of shillings in first bag,
Then $228 - x$ = ,, sovereigns in second bag;
$\therefore x + 20(228 - x)$ = value of first bag in shillings,
And $20x + 228 - x$ = ,, second ,, ,,
$\therefore x + 20(228 - x) = 2(20x + 228 - x)$
$x + 4560 - 20x = 2(19x + 228)$
$4560 - 19x = 38x + 456$
$-19x - 38x = 456 - 4560$
$-57x = -4104$
$\therefore x = 72.$

∴ No. of shillings in first bag = 72
,, ,, second ,, = 156 } Ans.

2. TARDUS.—A man inheriting money spends on the first day 19s., twice that sum on the next day, and 19s. additional every day till he exhausts his fortune by spending on the last day £190. What had he to start with?

This is a question in Arithmetical Progression, where a (first term) = 19, d (difference) = 19, l (last term) = 3,800, and s (sum) is required.

Let n = No. of terms,

Then, $l = a+(n-1)d$

$3{,}800 = 19+\{(n-1)\times 19\}$

$= 19+19n-19$

$19n = 3{,}800$

$\therefore n = \underline{200}$

$S = (a+l)\frac{n}{2}$

$= (19+3{,}800)\times\frac{200}{2}$

$= 3{,}819\times 100$

$= \underline{381{,}900}.$

$\therefore$ Sum = 381,900s. = $\underline{£19{,}095}$. Ans.

3. FOLKESTONIAN.—Sum the following:—

$\sqrt{\frac{2}{3}} - \sqrt{6}+2\sqrt{15}$ – to 8 terms.

(*Hamblin Smith.*)

Here $a = \sqrt{\frac{2}{3}}$, $r = -\sqrt{10}$, $n = 8$.

$$S = \frac{a(r^n-1)}{r-1}$$

$$= \frac{\sqrt{\frac{2}{3}}\{(-\sqrt{10})^8-1\}}{-\sqrt{10}-1}$$

$$= \frac{\sqrt{\frac{2}{3}}(10{,}000-1)}{-\sqrt{10}-1}$$

$$= -\frac{9{,}999\sqrt{3}}{(\sqrt{10}+1)\cdot\sqrt{5}}.$$ Ans.

4. SILVIUS.—What is the price of oranges if, when I get two more for one shilling, they are one penny per dozen cheaper?

Let x = cost per dozen in pence,

then $\frac{144}{x}$ = no. obtained for a shilling,

and $\frac{144}{x-1}$ = " " " when one penny a dozen cheaper;

$$\therefore \frac{144}{x-1} - \frac{144}{x} = 2$$

$$\frac{72}{x-1} - \frac{72}{x} = 1$$

$$\frac{72}{x^2-x} = 1$$

$$x^2-x = 72$$

$$x^2-x+(\tfrac{1}{2})^2 = 72+\tfrac{1}{4}$$

$$= \frac{289}{4}$$

$$x-\tfrac{1}{2} = \pm\frac{17}{2}$$

$\therefore x = 9$ or -8.

$\therefore$ Price per dozen = $\underline{9d.}$ Ans.

5. F. S.—Having given

$a^2(b-c)x+b^2(c-a)y+c^2(a-b)z=0$,

and $(b-c)yz+(c-a)zx+(a-b)xy=0$,

prove that $ax=by=cz$.

(*Cambridge Local*, 1880, *Junior Algebra.*)

If $a^2(b-c)x+b^2(c-a)y+c^2(a-b)z=0$,

and $(b-c)yz+(c-a)xz+(a-b)xy=0$,

Then, (1) $a^2x = yz$

(2) $b^2y = xz$

(3) $c^2z = xy$

(1) × x: $a^2x^2 = xyz$

(2) × y: $b^2y^2 = xyz$

$\therefore a^2x^2 = b^2y^2$

$\therefore ax = by$.

(1) × x: $a^2x^2 = xyz$

(2) × z: $c^2z^2 = xyz$

$\therefore a^2x^2 = c^2z^2$

$\therefore ax = cz$.

$\therefore \underline{ax=by=cz}$. Ans.

6. YRREB.—Some smugglers found a cave, which would just exactly hold the cargo of their boat, viz., 13 bales of silk and 33 casks of rum. While unloading, a revenue cutter came in sight, and they were obliged to sail away having landed only 9 casks and 5 bales, and filled $\frac{1}{3}$ of the cave. How many bales, or how many casks would it hold? (*Colenso.*)

Let x = space occupied by a bale of silk,

And y = " " cask of rum;

Then $13x+33y = 3(5x+9y)$

$= 15x+27y$

$15x-13x = 33y-27y$

$2x = 6y$

$\therefore x = 3y$.

$\therefore$ No. of bales = $13+\frac{3\cdot 3}{3} = 13+11 = 24$,

And " casks = $\underline{24\times 3 = 72}$

7. DESIROUS.—Solve:—

(1) $x^2+2xy-y^2 = a^2+2a-1$

(2) $(a-1)x(x+y) = a(a+1)y(x-y)$

(2) $(a-1)x(x+y) = a(a+1)y(x-y)$

$$\frac{x(x+y)}{y(x-y)} = \frac{a(a+1)}{a-1}$$

$$\frac{x^2+xy}{xy-y^2} = \frac{a^2+a}{a-1}$$

Adding and subtracting numerator and denominator—

$$\frac{x^2+2xy-y^2}{x^2+y^2} = \frac{a^2+2a-1}{a^2+1}$$

$\therefore \underline{x^2+y^2 = a^2+1}$.

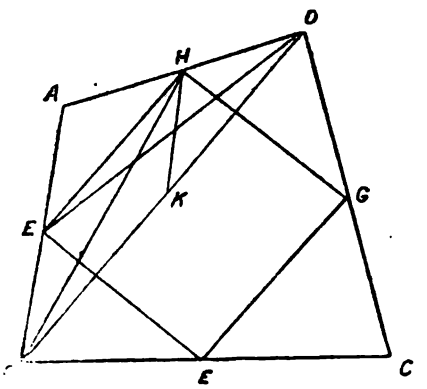
It is evident that the values, $x^2=a^2$, $y^2=1$ satisfy this equation.

$\therefore \underline{x=\pm a,\ y=\pm 1}$.

Note.—Area of Egypt is 176,000 square miles.

Geometry.

1. MOONRAKER.—Prove that the quadrilateral formed by joining the middle points of the sides of any quadrilateral is a parallelogram; and that its area is half that of the given quadrilateral. (June Matric. 1882, London University.)



Let ABCD be a quadrilateral, and let E, F, G, H be the middle points of the sides.

Then the quadrilateral EFGH is a parallelogram, and it is half of the quadrilateral ABCD.

Join BD, ED, HB.

Proof.—Because AE = EB, (Hyp.)

$\therefore$ triangle AHE = triangle EHB; (I. 38.)

and because AH = HD,

$\therefore$ triangle AEH = triangle HED;

Wherefore triangle EHB = triangle HED; (Ax. 1.) and these triangles are upon the same base EH and upon the same side of it;

$\therefore$ EH is parallel to BD. (I. 39.)

Similarly it can be proved that FG is parallel to BD;

$\therefore$ EH is parallel to FG. (I. 30.)

In the same manner it can be demonstrated that EF, HG are parallel.

Hence the quadrilateral EFGH is a parallelogram. (Def. A.)

Again, join H with K, the middle point of BD.

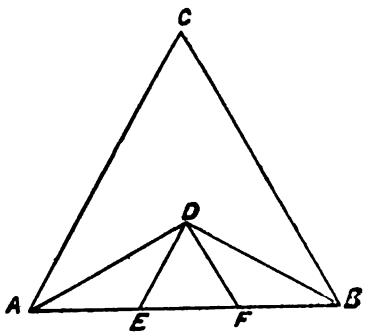
Then HK is parallel to EB, and EBKH is a parallelogram.

Triangle AEH = triangle HKD, (I. 26.)

and triangle HKD = half of the parallelogram EBKH;

∴ triangle AEH = one-fourth of the triangle ABD.
Similarly it can be proved that triangle CFG = one-fourth of the triangle BCD.
Therefore triangles AEH, CFG together equal one-fourth of the quadrilateral ABCD.
In the same manner it can be demonstrated that the triangles BEF, DGH together equal one-fourth of the quadrilateral ABCD.
Therefore the four triangles AEH, BEF, CFG, DGH together equal one-half of the quadrilateral ABCD.
Wherefore the parallelogram EFGH is half the quadrilateral ABCD. Q. E. D.

2. ORGETORIX.—Trisect a given finite straight line.

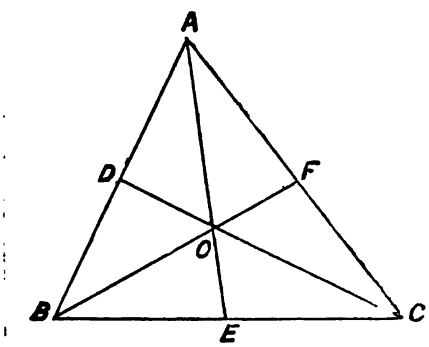


Let AB be the given straight line.

Construction.—Upon AB describe an equilateral triangle ABC; (I. 1.)
Bisect the angles at A and B by the straight lines AD, BD, meeting in D; (I. 9.)
Through D draw DE parallel to AC, and DF parallel to BC. (I. 31.)
Then AB shall be trisected in the points E, F.

Proof.—Because AC is parallel to DE,
∴ alternate angles CAD, ADE are equal; (I. 29.)
but angle DAE = angle CAD; (con.)
∴ angle DAE = angle ADE,
wherefore ED = EA. (I. 6.)
Similarly it can be proved that FD = FB.
Angle DEF = angle CAB, (I. 29.)
and angle DFE = angle CBA,
∴ remaining angle EDF = remaining angle ACB; (I. 32.)
hence the triangle EDF is equilateral,
and ED, FD = EA, FB, respectively,
∴ AE, EF, FB are equal to one another.
Q. E. F.

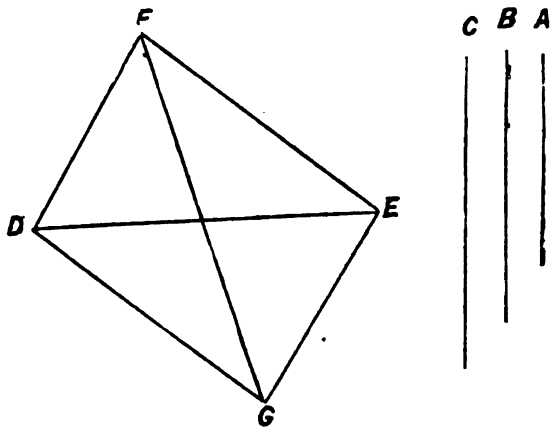
3. DEDUCTION.—If the sides of any triangle be bisected, and lines drawn from points of bisection to opposite angles, these lines will meet in one point.



Let ABC be a triangle, and let D, E, F be the points of bisection of the sides; draw BF, CD, intersecting in O, and join AO, EO.
Then AOE shall be a straight line.

Proof.—Because AD = DB, (Hyp.)
∴ triangle ADC = triangle BDC (I. 38);
wherefore triangle BDC is half the triangle ABC.
Similarly it can be proved that triangle CBF is half the triangle ABC;
∴ triangle BDC = triangle CBF; (Ax. 7.)
take from these equals the triangles BOC,
∴ triangle DOB = triangle FOC; (Ax. 3.)
Triangle AOD = triangle DOB, and triangle AOF = triangle FOC; (I. 38.)
∴ triangle AOD = triangle AOF;
and triangle BOE = triangle COE; (I. 38.)
∴ the three triangles AOD, DOB, BOE = the three triangles AOF, FOC, COE; (Ax. 2.)
Wherefore the line AOE bisects the triangle ABC; but the straight line drawn from A to E bisects the triangle ABC;
∴ AOE is a straight line.
Wherefore the three straight lines AE, BF, CD intersect in one point. Q. E. D.

4. W. J. P.—Given two contiguous sides, and a diagonal of a parallelogram, show how to find the other diagonal. (P. T.'s Examination, *January*, 1880.)



Let A, B be the lengths of the contiguous sides, and C the length of the given diagonal.

Construction.—Take DE = C;
From D with radius = A, and from E with radius = B, draw arcs intersecting in F;
From E with radius = A, and from D with radius = B, draw arcs intersecting in G;
Join FG; then FG shall be the other diagonal of the parallelogram.
Draw EF, EG.

Proof.—In the triangles DFE, EGD,
The two sides DE, EF = the two sides ED, DG, each to each,
and the base DF = the base EG,
∴ angle DEF = angle EDG; (I. 8.)
Wherefore EF is parallel to DG; (I. 27.)
Similarly it can be proved that DF is parallel to EG; or it can be proved by (I. 33);
∴ DGEF is a parallelogram; (Def. A.)
and consequently FG is the other diagonal.
Q. E. F.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR OCTOBER, 1882.

EXERCISE XII.

(1) $\frac{m}{n}$; $\frac{pq}{rs}$; $\frac{x}{y}$. (2) $\frac{ab}{def}$; $\frac{pqr}{xyz}$. (3) x^4; a^3; a^3b. (4) a^2b; mn^5. (5) 1; 1; 1. (6) $12abc$; $-9x^2y$. (7) $6003ab^2c$. (8) $112ac^2$. (9) $\frac{x}{y}$ pounds. (10) 60.

EXERCISE XIII.

(1) $x+y+z$. (2) $b-4a+6ab$. (3) $-ax+5a^2-2ax^2+3$. (4) $\frac{1}{2}a^2-\frac{1}{3}ax+\frac{5}{6}x^2-\frac{1}{2}ax^2$. (5) $12a^2y^2-5xy^2z+6y^2z^2$. (6) $1:-3$. (7) $a+b$. (8) $a-b$. (9) x^2-3xy. (10) $3x-4y$. (11) $3x-2y$. (12) $x+5$. (13) $a^2-8a-20$. (14) $8x^3+12x^2y+18xy^2+27y^3$. (15) $a^4+2a^3+3a^2+4a+5$. (16) $1+5x+15x^2+45x^3+$ etc.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR OCTOBER, 1882.

STANDARD III.

A. 1. 4808—7.
2. 19,545—34.
3. 293—49.

B. 1. 51,312—57.
2. £39 2s. 9½d.
3. 23,729 pence.

C. 1. £9160 1s. 10½d.
2. 831—359.
3. £599 19s. 8¾d.

D. 1. 56—841.
2. £643 11s. 6¾d.
3. 2826 stamps.

E. 1. £1 13s. 4d.
2. 75—5190.
3. £10,220 12s. 3d.

F. 1. £816 2s. 11¾d.
2. £5 8s. 8¾d. less.
3. 485 ducks.

ADVANCED EXAMINATION.

1. 60 miles.
2. £8 15s.
3. £5607 13s. 8¾d

STANDARD IV.

A. 1. £811 2s. 0¾d.
2. £7171 13s. 10½d.
3. £882 13s. 8¾d.—6.

B. 1. £850 4s. 7¾d.
2. 166,656 oz.
3. £5922 10s. 0¾d.

C. 1. £3 3s. 9¾d.—137.
2. 60 shirts, & 1yd. 1qr. left.
3. 141 lb. 11 oz. 8 dwt. 3 gr.

D. 1. 132 boys.
2. £1 13s. 6½d.
3. 5¾d.—2491.

E. 1. £18 15s. 9d.
2. £55 6s. 3d.
3. 198 yd. 3 qr. 2 nl. 1¼ in.

F. 1. 54,722½ sq. ft.
2. 1080 eggs.
3. 20,939,520 oz.

ADVANCED EXAMINATION.

1. £785 8s. 4d.
2. 2½ days.
3. 11½ lb. each horse.

STANDARD V.

A. 1. £44 5s. 7½d.
2. £172 3s. 7½d.
3. £257 3s. 2½d.

B. 1. £3 18s. 5¼d.
2. £732 14s. 0½d.
3. £2 3s. 9d.

C. 1. £3097 0s. 1¾d.
2. £73 0s. 0½d.
3. £19 5s. 6½d.

D. 1. £60,282 4s. 2d.
2. £18 17s. 9¾d.
3. 114 balls.

E. 1. £465 12s. 6d.
2. £113 6s. 10½d.
3. £26 14s. 11d.

F. 1. £43 17s. 6d.
2. £10 4s. 9d.
3. £53,840 13s. 0½d.

ADVANCED EXAMINATION.

1. £19 11s. 7½d.
2. 24 yards.
3. £206 9s. 2d. gain

STANDARD VI.

A. 1. $1\frac{1}{10}$.
2. $\frac{1}{10}$.
3. $7\frac{7}{10}$.

B. 1. 12·29.
2. ·05148.
3. ·00109375.

C. 1. 19s. 3d.
2. £2 3s. $9\frac{7}{16}$d.
3. $\frac{17}{18}$.

D. 1. $2\frac{1}{3}\frac{1}{3}\frac{1}{3}$.
2. £8260869+
3. 18 days.

E. 1. $\frac{7}{15}$.
2. $5\frac{9}{11}\frac{9}{11}$d.
3. 44 to 43.

F. 1. £1327 1s. 8d.
2. $2\frac{1}{3}\frac{1}{3}$.
3. 12s. $10\frac{9}{11}$d.

ADVANCED EXAMINATION

1. 64 to 25.
2. £15 11s.
3. 1·5779+lb.

STANDARD VII.

A. 1. £15.
2. £101 12s. 6d.
3. 6½ per cent.

B. 1. £845 4s. 4½d.
2. 15s. 3d.
3. $3\frac{8}{11}$ per cent.

C. 1. £8116 17s. 6d.
2. $6\frac{2}{3}$ per cent.
3. $2\frac{1}{7}\frac{9}{7}\frac{4}{7}$ years.

D. 1. £739 2s. $7\frac{7}{13}$d.
2. $2\frac{1}{2}$ per cent.
3. £4 9s. 7½d. loss.

E. 1. $41\frac{7}{8}$ per cent.
2. £1 4s. $6\frac{1}{2}\frac{1}{3}$d. a cwt.
3. £127 7s. 10·5408d.

F. 1. £204 10s. $10\frac{1}{1}\frac{1}{1}$d.
2. $14\frac{3}{8}$ p.c. additional.
3. £79 14s. $8\frac{8}{1}\frac{8}{1}$d. P. W.

ADVANCED EXAMINATION.

1. £20 14s. 3¾d. increase.
2. £35 16s each horse.
3. $5\frac{8}{6}\frac{8}{6}\frac{8}{7}$ months.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR OCTOBER, 1882.

STANDARD III.

1. ½d. × 200 = 50d. cost of scholars for *one* mile.
½d. × 60 = 30d. ,, adults ,, ,,
£20 or 4800d. ÷ 80d. = 60 miles. Ans

2. 3s. 6d. × 3½ = 12s. 3d. value of a turkey, but it is also the value of a goose and a hare. Then 12s. 3d. − 3s. 6d. = 8s. 9d. value of a goose, and 8s. 9d. × 20 = £8 15s. Ans.

3.

	£	s.	d.
80,049 g. =	84,051	9	0
75,306,013 f. =	78,443	15	3½
	£5607	13	8½

Ans.

STANDARD IV.

1. 8000 at 9½d. = 76,000l. cost of excavating.
8000 c. y. = 9000 ton at 12½d. = 112,500d. ,, carting.
Total 188,500d. = £785 8s. 4d. Ans.

2. 4s. 9d. × 20 = £4 15s. wages for the full time.
£4 15s. − £4 3s. 1½d. = 11s. 10½d. wages lost.
11s. 10½d. ÷ 4s. 9d. = 2½ days. Ans.

3. 12 ton 14 cwt. 2 qr. 26 lb. = 28,530 lb.
13½ lb. × 118 × 10 = 15,930 ,, eaten by cows.
12,600 ,, ,, ,, 112 horses in 10 days.
12,600 lb. ÷ (112 × 10) = 11¼ lb. Ans.

STANDARD V.

1. 14½ at 4s. 9d. = £3 7s. 8½d., 243½ at 5½d. = £5 11s. 7½d., 7⅞ at 16s. 9d. = £6 9s. 9¾d., 48¾ at 1s. 4½d. = £3 6s. 8¼d., 2⅛ at 5s. 6d. = 11s. 9¾d.; = total £19 11s. 7½d. Ans.

2. A does (4+8=) 12 yds. more than C, and B does 8 yds. more than C, hence they together do 20 yds. in excess of each doing as much as C.
Then (92 − 20=) 72 ÷ 3 = 24 yds. Ans.

3.

	£	s.	d.	
3,600,000 = 25,000 gross, at 4½d. =	442	14	2	selling price.
3,600,000 = 3,600 thousand at 1s. 3¾d. =	236	5	0	cost ,,
Ans.	£206	9	2	gain.

STANDARD VI.

1. Taking the unit of work to be a ton drawn a mile, we have, (160 ton × 3=) 480 ÷ (8 × 4 × 10=) 320 = 1½ of the above units each horse per hour. Again, (180 ton × 5=) 900 ÷ (12 × 16 × 8 =) 1536 = $\frac{7}{1}\frac{5}{3}\frac{0}{6}$ frac. of the above unit each donkey per hour. Hence the ratio is 1½ to $\frac{7}{1}\frac{5}{3}\frac{0}{6}$ = 192 to 75 = 64 to 25. Ans.

2. 1 − ⅝ = ⅜ the remainder, and ⅜ of ⅜ = ¼ of the whole; hence £3 17s. 9d. × 4 = £15 11s. Ans.

3. ·88 × 1·15 = 1·012 lb. of bread from 1 lb. of wheat.
3·55 × 2240 × 1·012 = 8047·424 bread consumed.
8047·424 ÷ (850 × 6=) 5100 = 1·5779+lb. Ans.

STANDARD VII.

1. £2450 10s. ÷ 84½ = 29 cents. of 4 per cent. stock bought.
£4 × 29 = £116 income arising for 4 per cent. stock.
£88 × 29 = 2552 received on selling out.
£2552 ÷ 70 = $36\frac{1}{3}\frac{2}{3}$ cents. of railway stock bought.
£3⅜ × $36\frac{1}{3}\frac{2}{3}$ = £136⅔ income from railway stock.
£136⅔ − £116 = £20⅔ = £20 14s. 3⅞d. increase. Ans.

2. 2000 g. = £2100, 30 per cent. on which = £630; hence the whole must be sold for £2730.
(£35 × 25=) £875 + (£32 × 30=) £960 = £1835 received for 55 horses. Then £2730 − £1835 = £895 selling price of remaining 25; and £895 ÷ 25 = £35 16s. each. Ans.

3. £85 − £83 7s. 6d. = £1 12s. 6d. discount allowed; it is also the interest that £83 7s. 6d. at 4 per cent. would make in the given time. A *year's* interest on £83 7s. 6d. at 4 per cent. = £3 6s. 8¾d., and £1 12s. 6d. is $\frac{1}{3}\frac{0}{0}\frac{0}{0}\frac{0}{0}$ of this year's interest = $5\frac{8}{1}\frac{8}{4}\frac{8}{7}$ months. Ans.

The question may be thus more simply presented, and then worked by proportion:—If £100 makes £4 interest in 12 months, in what time would £83 7s. 6d. make £1 12s. 6d.?

Gossip.

The *Century* for August has an interesting paper on 'The Borderlands of Surrey,' the scenery of which George Eliot said pleased her more than any she knew of in England. An illustration is given of Brookbank, the old two-storied cottage in which the great novelist lived whilst she was writing 'Middlemarch.' Ten minutes' walk from this quaint home there is a picturesque old farmhouse, and we are told that 'George Eliot would often visit the farmer's wife, and sitting on a grassy bank just beside the kitchen door, would discuss the growth of fruit and the quality of butter in a manner so quiet and simple, that the good country people were astonished, expecting very different conversation from the great novelist.' Tennyson's house is three miles from Shotter Mill, and the thoughtless, ill-bred curiosity of tourists is a great annoyance to the poet. Mr. Cosmo Monkhouse contributes an article to this magazine on 'Some English Artists and their Studios,' and the studios illustrated are those of Leighton, Millais, Pettie, Prinsep, Boughton, P. R. Morris, Linton, and Alma-Tadema.

***

It is stated that the authorised life of Longfellow will be written by his brother, the Rev. Samuel Longfellow, who has resigned his pastoral charge in Germantown, Pennsylvania, and has come to live with the poet's daughters in the house at Cambridge.

***

M. Renan will publish a translation of the Psalms on his return from the East.

The £5 prizes given by the Syndicate to the five women highest in the list who are preparing for the profession of teaching, have been awarded to Miss Benson, Hertford (Cambridge Centre); Miss Marr, Clapham Middle School (London Centre); Miss Hewett, Launceston (Plymouth Centre); Miss Willoughby, High School, Plymouth (Plymouth Centre) Prizes of £2 10s. each, under the same conditions, were given to Miss Bennett, Birmingham (Birmingham Centre); Miss C. Frost, Cambridge (Cambridge Centre); and Miss F. R. Gray, Roscrea, Ireland (Cambridge Centre). The Lowman Memorial Prize was awarded to Miss Willoughby, High School, Plymouth (Plymouth Centre); and the prize for Italian to Miss Garnett, Welwyn, Herts (London Centre).

***

The American Spelling Reform Association, at its sixth annual meeting, recently held at Harvard University, has established a league of persons pledged to use simplified spelling beginning with such amended words as are found in Worcester's and other dictionaries—*program*, *iland*, *sovran*, *rince*, *ake*. Professor D. W. Whitney, of Yale, was the first signer of the league, and Professor Scott, of Columbia, has been commissioned to draw up a list of such simplified spelling.

***

Professor Knight's 'Wordsworth' (Edinburgh: W. Paterson) is a most valuable edition of the poet's works. The poems are arranged chronologically, the latest text is given, and there are valuable notes on places, persons, and textual readings.

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BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),

Vice-President of the British Medical Association.

IX.

THE MOUTH AND THROAT.

THERE are some affections of the mouth which are sometimes very troublesome, and cause much discomfort to children, and in consequence to teachers, such as *Aphthous Ulcers, or Thrush, Cankers, Gumboils, Teething, Toothache, Relaxed Throat,* producing hoarseness, *Aphonia* or loss of voice, *Cough, Hooping Cough, Croup.* These form a convenient section of complaints which may be considered together, and naturally follow quinsy.

Aphthæ are small round white ulcers, which look like particles of cream or curd lying upon, or as if inserted in, the mucous membrane. They are sometimes called *Thrush*, and old women tell us that they are fatal signs when they come on at the end of acute or exhausting diseases. These patches are of considerable interest to the microscopist; they consist of epithelial scales mixed with the isolated cells of a fungus, and with long filaments, which are rarely jointed. The scales are more or less opaque; intermingled with them are the multiplying bodies of vibrios, and bacteria. They are evidences of a defective vitality in the individual, which allows of the development of fungi in places where the ordinary healthy secretions usually have power to prevent their growth. Their presence indicates the necessity for the removal of decaying *débris* from the mouth and alimentary canal, and for disinfectants. The mouth may be washed frequently with a solution of chlorinated soda or a weak solution of Condy's fluid, and the places touched with a strong solution of borax in glycerine. Sometimes small ulcers form in the membrane, which is excessively painful when irritated by liquids or any food. These ulcers have raised edges, with bright red surroundings. They frequently form inside the lips and on the tip of the tongue, and should be gently touched with a solution of nitrate of silver (three grains to one dram of distilled water). If this is done two or three times on successive days, the pain will be at once removed, and the places will rapidly heal.

Cankers, so-called, are owing to want of cleanliness, the presence of carious teeth, to disordered stomach in consequence of eating improper food, or continuing to feed either on that which is unwholesome or on a diet which is too exclusively animal. I have thought that the use of milk or meat which is the product of animals suffering from some feverish complaint has promoted the formation of aphthæ, but this point has not yet been conclusively proved.

Gumboils frequently arise in connection with an aphthous condition, but there is always a decayed tooth which has some decomposing matter in its substance. The discharge from the inflamed part must be promoted by washing the mouth with warm water, and by holding the water in the mouth for a few minutes at a time. A soft fig, made quite hot in the oven, then cut in half, and the soft side applied over the boil, so as to avoid absolute pressure on the tender part, and kept in position as long as possible, will be the most comfortable way to apply a poultice. If the pain continues to be very acute the surgeon's lancet may be the best remedy, and after the inflammation has subsided the carious or necrosed tooth should be removed, if it continues to be tender to the touch. If the tongue is foul and the breath offensive it will be right to administer a simple aperient, such as a dose of Gregory's powder, or some fluid magnesia, or even an emetic, if the stomach is loaded with undigested food.

Teething and Toothache.—Gumboils frequently accompany toothache. The acuteness of the pain of this agonising disorder is often relieved as soon as swelling takes place. When this is the case it indicates peri-dental inflammation, that is, an inflammation in the membrane covering the fang of the tooth. It is generally connected with some constitutional disorder, as a cold, or other disturbing cause. When there is acute pain on touching the tooth, warm fomentation in the mouth, and protection from outer cold, is the best treatment. The sufferer will find breathing through the nose (rather than the mouth) to be the best way to draw in air, for a draught of cold air impinging on the exposed nerve is a source of pain. Irritating applications, such as creosote or spirits of any kind, which are often used to allay pain, are of no service whatever. They only add to the mischief; although they may relieve pain for the moment, it is sure to return again more severely than before. Swelling of any kind near to a tooth

should be treated tenderly with fomentations, and the use of liquid food until the boil has softened and discharged. If the tooth is hollow or carious, the pain sometimes may be relieved by picking out of the hollow tooth some small particle of decomposing food or some portion of hard matter which presses upon the exposed and inflamed nerve. Even by protecting the latter from the air by inserting a flake of cotton-wadding, soaked in some disinfectant and inserted very carefully, so as to avoid all pressure upon the nerve, we may save the little patient some suffering. If there is extending decay in the tooth it may be arrested by active astringents or stimulating applications, such as creosote, camphor, or essential oils; but all these kinds of applications are of doubtful utility in the end. They relieve pain for the moment, but it is sure to come again. Soda will arrest fermentation for a time, and so may ease suffering when it arises from this cause. All these actions indicate decay in the teeth, and require the care of the dentist to arrest its extension.

Loose teeth should always be removed, as they only cause irritation in the gums, and interfere with the formation of healthy saliva. They prevent the child from masticating his food properly, and lead him to swallow it uncomminuted, and thus throw a duty upon the stomach which it is not always able to perform. There is consequent indigestion, and with it an inability to do the mental task which the rules of the school require to be done. The child is then blamed improperly and unjustly. He knows that the fault is not altogether his own, and so a loose fang may be the first cause of mutiny and disorder among the scholars. These latter conditions, when they arise, are generally founded upon some concealed injustice in school-life as well as in the weightier arrangements of state government, and concerning which the actual governor is too often ignorant.

There is a condition connected with teething which is not often thought of. We are generally inclined to think that teething ceases when swaddling clothes are put aside, and that the second set give no trouble on this head. This is not so; the second set of teeth often set up a considerable amount of nerve irritation when they come through the gums, especially if they have not followed the usual order, and have not at once taken the place of the milk-teeth which have preceded them in the gums. This is not quite so absolute in the case of those teeth which have a predecessor proper; but the canines or eye-teeth often produce headache, and cause an interference with eye-sight when they are about to pierce through the gums, producing a congestion in the conjunctival membrane. This condition is not ordinarily considered, but the frequency with which headache, and a tendency to cold in the eyes, as it is called, is associated with a canine tooth about to pierce the gums, satisfies me with the correctness of the association, and the necessity which exists in such cases to attend to the digestion and to the nervous system, rather than to the discharge from the eyes and nose, which is only an accompanying discomfort. The nerve disorder which attends upon cutting the wisdom-teeth is even more decided than that which accompanies canine dentition. The gums get swollen and hot, the secretion of saliva is lessened, the tenderness interferes with mastication, and food is swallowed in lumps, indigestion arises and still further complicates the case. If the patient be exposed to draught, or kept in a heated room until the skin acts freely and is then chilled by cold air, sore throat, or at least a relaxed throat, arises, cough sets in, perhaps bronchitis or some other feverish condition; the minor evil, which was the first cause, is lost sight of, and the major trouble treated. The gum irritation subsides when the disease which it has set up is gone, and solid food begins again to be taken, the gum is bitten upon and again crushed. There is a recurrence of the whole story, but the real offender is not thought of. I have seen convulsions of a serious character arise in cases of this kind, which have recurred, and in the end would have set up distinct epilepsy, but for the discovery that a wisdom-tooth was at the root of the evil. The offending gum has been lanced, and the convulsive tendency has ceased at once. Wisdom-teeth are not to be neglected when they are being cut. They are the last to come, and generally they are the first to go, and we have a series of throat affections connected with their entrance into the mouth as well as with their removal therefrom.

It is necessary for the schoolmaster to be aware of the fact that dyspepsia, headache, relaxed throat, cough, croup, and even convulsions may be simply dependent upon a decayed or cutting tooth. Fœtid breath very often indicates a number of decaying teeth in the mouth. If food is left for a few hours in a hollow tooth it is sure to become more or less putrid, and serious disorders or continued bad health may be produced by a small particle of decaying animal matter in a hollow tooth.

Large schools should always have dental officers attached to them, who, by a periodical inspection of the teeth of the children will be able to avert decay, remove loose fangs before they produce general disorder, and this may be the means of stopping the progress of much dental mischief.

It is not sufficiently known that the second set of teeth appear in the mouth before the first set are shed. A child six years old will generally have twenty-four teeth whilst there are only twenty temporary. The extra four are the first permanent or six-year old molars. They are supposed to belong to the first set, and when they decay, which is often the case, it is thought to be of no consequence. These teeth often have slight decay in the enamel, which may be arrested if it is seen soon enough. They are the largest teeth in the mouth, and should never be removed unless absolutely necessary in consequence of complete destruction. They should be stopped if the decay is discovered early enough, and if stopping cannot be effected, a free application of disinfectants before and after food will assist to limit the ravages of the caries, and be the means of saving the tooth until the jawbone is properly developed. Parents should bear in mind, and dentists also, that the too early removal of a permanent tooth interferes with the regularity of the development of the jawbone, and sooner or later is followed by other changes.

The deposit of so-called tartar upon the teeth is always a matter which requires attention. The deposit is various in its constituents: it consists of organic as well as inorganic matter; there is *débris* of food as well as *débris* of animal life; its presence depends upon a constitutional as well as a local cause. If removed it often rapidly forms again. The cause must be corrected by an attention to the condition of the digestive organs, and a rapid

removal of the collected tartar, especially when, as is generally the case, it is accompanied by fœtid breath. The varieties are numerous, but the majority can be easily remedied by the proper use of disinfectants. If there is any inflammation or sponginess of the gums, or tendency to hæmorrhage, each must be treated independently of the formation of the tartar; and it is probable that if the one condition is removed, the other will cease. Hæmorrhage, or bleeding from the gums, is sometimes an evidence of improper feeding; fruit and vegetables have been withheld, and a scorbutic tendency set up, which shows itself in loosening teeth and bleeding gums. The signs of mischief may be observed by the master, when the parents have not seen them, or have mistaken their significance. The state is one which can only be remedied by an alteration of diet, by a restoration of those kinds of food which nature requires. The aggregation of people in dense numbers, such as takes place in large cities, is a great impediment to the supply of the fresh fruit and vegetables; and yet such food is necessary for healthy digestion and a proper development of the second set of teeth.

When a teacher observes the state mentioned, it would not be out of place for him to send a line to the parent, and suggest more fruit and vegetables, and less animal food or pastry for the child. The removal of a tooth is occasionally followed by considerable bleeding; when there is constitutional tendency, it will be good for the child to take lime-juice, as well as well-cooked green vegetables, so as to remove the tendency to hæmorrhage, and to obviate further evil.

I am sometimes asked if tooth-powder is a necessary thing for a child to use, and how soon tooth-brushes become necessary articles for use in the bed-room. It is wise to clean the teeth with some antiseptic powder, such as finely-levigated chalk or charcoal, whenever the teeth are decayed, but ordinarily with undecayed teeth too much friction with the brush is to be avoided. It would be best to wash the mouth out, and to gently clean the teeth at bed-time, so as to remove decaying food from between the teeth and out of the hollows before it has had time to decompose, rather than leaving it all night in the mouth, and so causing offensive breath. This is the principal use which renders a toothbrush an advantage, which does not arise from the friction which is so often advised. You will not keep the teeth white by brushing them severely, but you may assist in doing so by removing decaying food from between them, and keeping the digestive organs in good order.

(To be continued.)

—o—

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BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

II.

'ON the 8th May, 1845—probably the most trying day in his public career—Mr. Stow stood for the last time in the splendid Normal College which he had founded and fully equipped. It was a beautiful summer morning, but the assembled pupils had evidently little heart for their accustomed play. The wheels of amusement moved heavily, and, except with the youngest, there seemed to be a prevailing consciousness of something wrong, something that ought not to be. Gloom was falling unnecessarily on sunny hearts. Two years had passed since many a manly tone had faltered as pastors, true to their cherished principles, closed their last services in the church they loved; and bitter tears had bedewed many a mother's cheek as she left the manse endeared by the tenderest associations of sorrow and joy, while distress had quivered on young lips as children left behind them their gardens and their play-fields. These changes had become inevitable, but the formal discipline might have been averted, which extended to the common school the gloom of the church and the manse. It engraved on young minds recollections of these inexplicable changes; but with many of the more advanced pupils it deepened the consciousness that Christian men could make heaviest and most enduring sacrifices for what they conscientiously held to be sacred principles.

'As Mr. Stow stood that morning among his students, masters, and brother directors, a slightly deeper flush than usual was all that indicated his disappointment. He accepted the new conditions of labour and resolutely strung himself to new exertion. Other hearts there are burdened with their own sorrows—one is taking a last look at the young currant-bush which he was permitted to plant on the border of the playground, and another has left a tear glistening on her favourite flower.

'But the signal for preparation to leave gathers into the large hall all stragglers. Thrilling is that song of praise, and deeply impressive that voice of prayer, as the goodness of the Lord is acknowledged and His guidance sought.

'The assembly moves from the building, directors, teachers, fifty students, 700 pupils, and at last the quiet old Janitor with his wife, locking the door and joining the procession, left a seminary, lately instinct with life, tenantless and silent.

The whole fabric is completely deserted; the joy of youthful voices thrills no listener, and the sunbeams, all the day pouring into empty halls, beating on the floor, and at last creeping slowly on the walls into twilight, only made the desolation greater. The procession—headed by Mr. Stow and Mr. Nathaniel Stevenson, a beloved companion and fellow-labourer in every good cause—having threaded its course through a multitude lining the streets, passes into the extemporised canvas-covered school. When the new seminary had been opened with praise and prayer, appropriate and hopeful addresses were delivered, but not a complaint was uttered, nor was there any special allusion to the circumstances in which they were placed. "Every person will admit," said Mr. Stow, "that the buildings of the institution are not the institution itself; even this temporary building, embodying as it does all the trainers, students, and children, will exhibit the system as it existed ten years previous to the erection of the edifice which we have now left; it was then the Glasgow Normal Seminary, and such it must continue to be!"'

The tents were the abode of the Normal Seminary until August, 1845, when the new building was formally opened, and the work continued still under Mr.

Stow's personal superintendence, and under more favourable outward circumstances. The Free Church had been led to accept the responsibility of many schools whose masters and mistresses had been dismissed, and in Edinburgh as well as in Glasgow a Normal College had to be formed for the preparation of teachers for their work. By the exertions of the Rev. Dr. James Buchanan, the Glasgow Seminary was erected at a cost of £10,000, of which sum £3,000 was a grant from Government. Students in the Scotch Colleges are not resident as in England. The new 'Seminary,' therefore, consisted only of four large halls for the model practising schools, with class-rooms, students' rooms, library, and museum, etc., with, of course, spacious playgrounds, in connection with the four schools.

Since the retirement, in 1840, of the Rev. Robert Cunningham, from the Rectorship, financial difficulties had prevented the appointment of a successor. On the entrance upon the new premises, however, Mr. Robert Hislop, who had for several years been the head master of the senior school, was chosen as the Rector. 'His exact scholarship, his thoughtful appreciation of Bible training, his deep sympathy, as a teacher, with Mr. Stow's views, and the command which his Christian character gave him over the students, invested his appointment with public value.'

Every one who reads this sketch will be acquainted with the 'Minutes of Privy Council of 1846,' but comparatively few can remember the surprise with which they were received, and the earnestness with which they were discussed in all parts of the country. As 'the result of one of the most benevolent, unfettered, and exact investigations of modern times made into the details of public instruction through individual enterprise,' they especially challenged the attention of all practical educationists. Mr. Stow's ardent Christian philanthropy was ready to accept any means of usefulness which these Minutes seemed to promise, and he sought to secure for Scotland such modifications as were more adapted to the long-established arrangements of that country. In this effort he was not sufficiently supported, and the 'Minutes' were therefore made applicable to England and Scotland alike. Monitors were to be superseded by pupil-teachers; Queen's Scholarships were offered; salaries were to be augmented by a direct grant from the Government, and according to a scale of nine degrees of merit; retiring allowances were promised; and in other details the Minutes framed by Sir James Kay Shuttleworth encouraged many, who, like Mr. Stow, were struggling hard against ignorance and vice, to hope for the most favourable results to the country.

Monitors were little used in Scotland, though in the schools founded by both Lancaster and Bell they were an important part of the 'system.' In his four 'departments' Mr. Stow dispensed with the aid of monitors in intellectual training. Children of nearly the same age were 'trained' together, and in large numbers. He demanded the best teachers for *all* grades; and he considered fifty to sixty or, at the outside, eighty children quite enough for one teacher. From want of funds this number has often been exceeded, and many 'trainers' have managed schools without assistance, even when the children have not been of 'nearly the same age.' But Mr. Stow always urged that in order to effective teaching, the numbers should be small, and he resisted the employment of inexperienced 'apprentices.' On every ground he demanded even for the youngest classes highly qualified teachers and carefully-trained assistants.

The effect of the operation of the 'Minutes' on the Glasgow Normal Seminary was distressing to Mr. Stow in the conversion of that institution into a teaching college. Many a University student had entered the Seminary for the one object of learning the theory and methods of education; but by the introduction of Queen's Scholars, the former class of students began to decline in numbers as they were excluded from the Government grants, and very shortly the principal part of the time and energy of the staff and students was devoted to the necessary preparation for the inevitable Christmas examination. Mr. Stow urged that separate colleges should be adapted to the completion of such education as the Government might demand from Queen's Scholars, and that all students who were duly qualified should subsequently pass to the Training College, and there learn the best methods of applying their knowledge for the purposes of instruction. 'If the arrangement of uniting instruction and training be continued in the same institution,' he added, 'then THREE YEARS, at the least, ought to be the minimum course, viz., two years in the preparatory college, and one year afterwards exclusively confined to the practical or normal as a separate department.'

It will be thus seen that Mr. Stow attached the highest importance to the training of the *teachers*, who, during their professional career, necessarily have the 'making or the marring' of so many minds, and the formation to a large extent of the moral character. He sought to secure men and women of sterling piety, and of considerable mental culture, and to give them a '*practical preparation* for the important work of communication and moral training, which was our original object in establishing the first Normal Seminary in this country, and without which all the theoretical knowledge that the students may acquire will not enable them to communicate it in a natural and efficient manner to the pupils who may eventually be placed under their charge.' 'Our experience during twenty years up to 1847, when we added a college to the Normal Department, was this, that six months' exclusive practical attention of well-educated young men to the normal, made better trainers and teachers of schools than the present course of two years does, or can do, with the college and normal combined.' Mr. Stow always affirmed that for the development of the child's intellectual faculties it was of far greater importance *how* he was taught, than *what* he was taught. Hence the anxiety manifest in the extracts quoted above for a proper equipment and skill on the part of the trainers. There is accumulating evidence that the opinion of practical educationists is now more in accord with these views of Mr. Stow.

In June, 1851, Mr. Robert Hislop resigned the rectorship of the Normal Seminary to enter upon another sphere of public usefulness, and again, for a period of six months, Mr. Stow had to bear the chief burden of the institution. Mr. Thomas Morrison, M.A., whose scholarship and success as a teacher had attracted the attention of the directors, was appointed rector in February, 1852, and 'Mr. Stow found in him a cheerful, energetic, and highly talented coadjutor.' Dr. Morrison still ably presides over the Free Church College.

For several years the work of the Normal Seminary

Institution was carried on without any changes of importance. The 'Minutes of 1846' and their supplements were confessedly conferring 'immense educational advantages' upon the country. The desire to have education placed on a national basis, however, led to the introduction of measures into Parliament which only 'secured ecclesiastical contests and merited rejection.' Mr. Stow naturally shunned controversy, but in some vigorously written pamphlets and letters he maintained the principles of Bible-training. He never attempted to 'mix religion with the multiplication table,' but he desired liberty to appeal to the Word of God at any hour of the day, and 'whether the classes were at arithmetic, at grammar, or in the play-ground,' to bring that Word to bear on lying, swearing, dishonesty, or any act of meanness that might occur. The particular schemes which he opposed need not now be named. While he required freedom for the teacher, he equally insisted upon the advantage and necessity of confining religious exercises—praise, prayer, and the Bible lesson—to a fixed hour. His one contention was: '*Scriptural* school-training is my only hope for the permanent elevation of the masses.'

The Social Science Congress was held in Glasgow in 1860, and under the presidency of Sir James Kay-Shuttleworth, a resolution was passed to appoint a committee to consider the whole question of education, with a view to instituting a national system. The committee failed, and legislation was attempted without the investigation upon which so much stress had been laid.

Mr. Stow made his last public effort at this Congress, by reading a paper on 'Moral Training' in the Educational section. The purpose of this devoted philanthropist was to show the advantages that would result from the universal adoption of the system which had been found to be so effective, especially in the more neglected districts of large towns.

The two greatest British educationists of the age, Sir James Kay-Shuttleworth and David Stow, were associated on this occasion. They lived 'for the same great end, the physical, social, and moral welfare of the people.' They both sought to secure that end through the same agency, the common school. They both embodied their conceptions in practical forms, and, notwithstanding unreasoning opposition, 'contributed more than all other men of their time to change the educational aspect of Britain.'

Mr. Stow's personal appearance was not such as to attract special attention. His stature was rather under the average height and 'on 'Change' he would not be specially distinguished from other first-class Glasgow merchants. His frank and open countenance seemed to challenge confidence, whilst shrewd intelligence and habitual caution could be read in his face, which, nevertheless, bore a most cheerful expression, with a genial humour ever manifest around his radiant eye. His emotions were readily interpreted by the easily controlled tones of a pleasant voice, as well as by the responsive play of his features. In the various benevolent enterprises to which he devoted his life, and especially in his Sabbath-evening school, his ready sympathies had been much exercised, and he had acquired a power of voice and gesture which made his manner a helpful expositor of his instruction. In this respect he was an example to all teachers, who often have to attract and sustain the attention of weary children, or 'picture out in words' novel or complex conceptions.

His enthusiasm was contagious, and as his unselfish labours were persistently pursued, the esteem of those who were trained under him merged into a desire to obtain more of his spirit and to imitate his example. Their character could be hardly formed on a better model, for in every respect Mr. Stow was a Christian gentleman. He was fortunate in securing for his Normal Seminary a staff of teachers of similar character and culture, and probably not a single student was ever known to leave the institution but with a feeling of regret at being removed from its ennobling atmosphere. Every student trained by Mr. Stow respected and loved him. The earnestness, the enthusiasm, the self-sacrificing devotedness of his life, won their admiration; while his courtesy and his personal interest in them all invariably gained their affections.

In the year 1850 a few friends resolved to present Mr. Stow with some expression of their regard for him as a Christian friend, and of their estimate of his labours as an educationist; but, their purpose being made known, others wished to join in the testimonial, which thus necessarily assumed a public character. Teachers sent contributions even from distant lands. The presentation took place in 1851, at a meeting presided over by Henry Armstrong, Esq., the Inspector of Wesleyan Schools, and which was attended by many distinguished educationists.

The chairman, in the course of his address, said: 'There are some men whom we are bound to honour, because God has honoured them, and separated them from the mass of their fellows by placing them in prominent positions, as the representatives of some great principle, and the instruments of some great work—men living before their age, labouring not only without sympathy or any just appreciation, but borne down by an amount of toil of which the world at large knows but little, whilst their actions and motives have been misunderstood. He held it as a fixed principle that no man had ever lived for the good of others, and had become a blessing to his species, since the Lord Jesus honoured humanity by clothing Himself with it, but by the denial of himself, taking up his cross and following his Master.'

An appropriate address was read by Mr. Caughie and given to Mr. Stow, and a marble bust resting on a beautifully proportioned column was uncovered and presented. On the pedestal was inscribed:—

DAVID STOW,
AUTHOR
Of 'Moral School Training for Large Towns,'
FOUNDER
Of the Training System of Education
and
Of the Glasgow Normal Seminary,
The First Established in Great Britain.
Presented by the Teachers Trained in the Institution.
1851.

The likeness was admirably rendered by the sculptor, Mr. H. Ritchie, of Edinburgh. A second bust had been provided for the hall of the Normal Seminary.

'The affectionate cordiality with which Mr. Stow was received when rising to reply must have been more welcome to him than the gift itself.' His speech was characteristic not only of his natural modesty and

Christian humility, but also of his unabated faith in the principles of the Training system, based as it was upon the Bible. The Revs. Dr. Buchanan, R. Cunningham (the former rector), Mr. Hislop (the actual rector), and others not directly engaged in educational work, united on this occasion in paying homage to the resolute founder of a system which had already proved itself to be so effective wherever it had been fairly tried. The occasion was one of great interest, and there are some still living to whom it remains a joyful memory.

The 'beautiful character' of Mr. Stow gradually unfolded in the privacy of domestic life does not of necessity come within our purview. But it may be recorded that by his marriage, in 1822, to Miss Marion Freebairn, a 'young lady of decided piety, highly accomplished, and of great personal attraction,' he was for nine years greatly aided in the work to which he had devoted his life. Mrs. Stow died in 1831. His eldest son, William, having distinguished himself at Cambridge, accepted the vicarage of Avebury, Wilts, and died in April, 1852. The next son, John, died in the following December. In 1841, Mr. Stow was united to Miss Elizabeth MacArthur, whose death took place in 1847. A son and a daughter survived their father.

During the last few years of his life, Mr. Stow was shut out from an active share in the work of the Normal College, and resided chiefly at the Bridge of Allan, occasionally visiting Torquay (1861) and other places to recruit his failing strength. But when he had reached the 'threescore years and ten' he could take but little active interest in educational affairs. His protracted illness resulted in continually increasing feebleness, and limited his visitors to a narrow circle. He constantly referred to his early experiences in the Sabbath-school, and, in reply to any who spoke of the great work done by him, in deep humility he insisted that he had been an 'unprofitable servant,' but thankfully acknowledged the results which had been developed from such unpromising beginnings. 'On the 6th of November, 1864, the day broke and the shadows fled. In his seventy-first year he finished his career Britain lost in him one of her foremost educationists. He yet lives in the heart and memory of those whom he led to consecrate their energies to the cause of Christian education, and who are now filling spheres of public usefulness in various parts of the world.'

—o—

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.
AND THEODORE WOOD, M.R.S.,
Joint Author of 'The Field Naturalist's Handbook.

No. XIV.—ELEPHANTIANA—*(continued.)*

STILL beyond a few remonstrances, no great objections were made to Jumbo's removal. Indeed, the generality of the visitors to the Zoological Gardens did not even know the animal's name, nor, indeed, could most of them distinguish one elephant from another. Even on the eve of his departure from England I heard several persons assert that the female Asiatic elephant ("Suffa-Kulli") was Jumbo, while, on the other hand, there were quite as many who pointed out Jumbo as one of the Indian elephants.

One morning, however, there appeared in one of the daily newspapers a vivid and dramatic account of an attempt to take Jumbo out of the Gardens, so as to accustom him to the road.

We were told how he suspected a trap, and bewailed his hard lot; how he knelt to his keeper, caressed him, and in all but human words besought for restoration to the home of his childhood. We learned how the other elephants from within their houses responded to his piteous appeal, and how they all rejoiced together when he returned among them.

As by magic, a Jumbo literature sprang up. The president, secretary, superintendent, and other officers of the Society were inundated with letters, mostly composed of vituperative epithets. Even persons like myself, who have no connection with the Society, but were known to take an interest in animals, received letters from all quarters on the same subject. None of the writers seemed even to conceive the idea that the officers of the Society were likely to understand their own business, and would not part from such an animal without very good reasons for doing so.

Then the Jumbo-worship set in. A Jumbo Rescue Fund was started. Presents of the most fatuous description were showered on the animal. Visiting cards with "farewell" were attached to his box, which was simply covered with farewell messages in pencil.

That basket after basket full of hot-house grapes should be given to him we can understand, though the grapes would have been better employed if given to sick poor who needed them, and who would not have eaten the baskets as well as the grapes.

But it is scarcely possible to conceive how many human beings could have been so ignorantly foolish as to present an elephant with several boxes of cigars, packets of snuff, a leg of mutton, and six dozen oysters.

From their nature these gifts seem to have been presented by donors of the male sex. But feminine presents are even more absurd than the masculine. No one, however imaginative, would have thought that a widow's suit should be sent to Alice, to be worn on Jumbo's departure. Or that numbers of ladies would send their photographs for Jumbo's consolation during his absence from them. Or that measurements of his travelling box should be taken, so that it might be decorated with wreaths of flowers.

Can anything be much more absurd than such conduct as the following? "On Wednesday, we saw a lady weeping copiously in the Gardens. With streaming eyes and a moist handkerchief, she was testifying to the violence of her grief, inveighing against the brutality of allowing Jumbo to *catch cold in his legs!*"

It is impossible not to recall Trinculo's soliloquy on discovering Caliban: "Were I in England now, as once I was, and had this fish painted, not a holiday fool but would give a piece of silver. When they will not give a doit to relieve a lame beggar, they will lay out ten to see a dead Indian."

One case, however, outdoes in absurdity all the previous instances of human folly. Here is an extract from the first column of a daily newspaper, the names being suppressed:—

"On the 27th ult." (*i.e.*, February, 1882) "at ——, the wife of H—— B——, Esq., of a son and heir (Jumbo)."

Here each sex is equally responsible, as both husband and wife must have concurred in saddling their unfortunate "son and heir" with a name that will afflict him during the whole of his life, and, if he should go to a public school, will be a perpetual torment to him. "Tristram Shandy," of Sterne, or Lord Lytton's "Anachronism," "Pisistratus Caxton," were nothing in comparison of "Jumbo B——."

Then legendary history was foisted upon Jumbo, and among other fables we were told that "he had been on exhibition at the London 'Zoo' for nearly sixty years, and that upon his back Queen Victoria and the royal family and thousands of children have ridden."

Now, all this outburst of Jumbo-worship was the work of a few days, the rest of the animal's life in the Zoological Gardens not exciting the least enthusiasm in the public mind, even among those who had ridden on his back when boys and girls, and had in after years lifted their own children into the familiar howdah.

Yet to all naturalists the years in which he passed from infancy to adult age were full of interest, and to none more so than to myself.

Some twenty-five years ago I stated ("Illustrated Nat. Hist.," i., p. 739) that I believed the African elephant to be quite as well fitted for the service of man, and that the reason why it was not captured and tamed might be found in the inferiority of the negro race when compared to the Aryan. Many of the elephants which were employed in the days of ancient history were undoubtedly of the African species, as were those highly-accomplished animals which are stated to have walked along a set of ropes, carrying a companion in a litter.

That an African elephant should be brought to England was an epoch in Zoology, especially as the animal was very young, and might therefore be expected to live sufficiently long to enable its disposition to be carefully studied. He was then scarcely as large as an ordinary Shetland pony, and, up to the present time, when he is eleven feet in height at the shoulder, and weighs some seven tons, he has proved quite as gentle and docile as any of the Indian animals. His compatriot "Alice" has also proved herself as intelligent and capable of subjection to man as either of the two Indian elephants.

Yet the art of elephant taming has not been practised in Africa for many centuries. The natives can kill them by catching them in pitfalls, or by the "drop-trap," *i.e.*, a device by which a log of wood, armed with a poisoned spike, or a long, double-edged blade, is dropped upon them from a height.

Some tribes, more courageous than the rest, can hunt down the animal, and mob it to death, flinging spears at it until the creature dies from weariness and its multitudinous wounds.

Bravest of all are the Agageers, so well described by Sir S. Baker.

They hunt the elephant in pairs, one being armed with a long, straight sword, the edge of which is kept as keen as that of a razor, and the other being unarmed. When they hunt, both mount the same horse, the armed man being behind.

Picking out an elephant with good tusks, they ride towards him and attract his attention. The man with the sword then slips off and hides himself under any convenient bush which they may pass. His companion then irritates the elephant, until it charges him. The horse, which is always of the swiftest kind, and carefully trained for the purpose, intentionally keeps just so far in front of the elephant that the latter thinks of nothing but catching it.

In course of the chase, the horseman passes close by his comrade's hiding-place, the elephant being too much excited to detect him. As the great beast passes, the hunter steps from his ambush, and with a single blow severs the tendon of the heel, which in the elephant is close to the ground. The animal is instantly rendered powerless, and can be killed without the possibility of resistance.

Even if the tendon be only partially severed, the next step is sure to snap it.

Yet in spite of the ingenuity of inventing such a feat, and the cool daring by which it is accomplished, no Agageer ever dreamed of taking the elephant alive. Nor would the Zulus, bravest of the brave as they may be, and utterly reckless of their own lives, attempt such a feat. They have been known to catch a lion alive, at the command of their king, but the very idea of taking an adult elephant alive would not have entered the head of Chaka himself.

Now, both the Agageers and the Zulus are of a much higher type than the negro, and it is therefore not at all wonderful that the negro cannot tame the elephant when tribes which are far superior to him fail to do so.

In general formation, both species very nearly resemble each other, and if the skull were removed, it would not be easy to decide whether the rest of the skeleton belonged to the African or Asiatic species. The form of the head is, however, very different, especially in the living animal.

In the first place, the enormous comparative size of the ears in the African species renders it so conspicuous that even when the animal is at rest and the ears are pressed closely against the head, there is no possibility of mistaking one species for the other. These ears, however, are best seen from the front, when the elephant is excited. In such a case, they stand out boldly on each side, looking like a pair of huge black wings.

Looking at the two species in profile, it is easy to see that the forehead of the African is convex, while that of the Asiatic is concave Looking at them from the front, the head of the African narrows below the eyes, and then widens again, very much like that of the hippopotamus.

Its form is due to the manner in which the tusks are set in their sockets.

In the Indian species, the sockets run nearly parallel to each other, so that the skull is of tolerably equal width.

Both species have the peculiarity that if, when wounded, they once fall, they never rise again. The lions, tigers, bears, and even the buffaloes, will spring to their feet even when mortally wounded, and often kill their slayer with their last struggles. But the dying elephant "subsides like a great hayrick," to use Mr. Sullivan's words, and expires so gently, that the hunter is often uncertain whether the animal be dead or merely resting.

Ivory workers often find bullets imbedded in the tusks. They have struck the root of the tusk, which is hollow, and filled with pulp, and have been gradually carried towards the tip by the growth of the tusk. In the ivory turners' department of the Crystal Palace, there are some very curious examples of imbedded balls. In one case, the track of the ball is

marked by a tunnel of bone extending across the base of the tusk, the ball itself having passed towards the point.

As is the case with the whale tribe, the brain of the elephant is very small in proportion to the size of the head, and is so deeply sunk in its bony outworks, that the hunter must aim as accurately as if shooting at a sparrow.

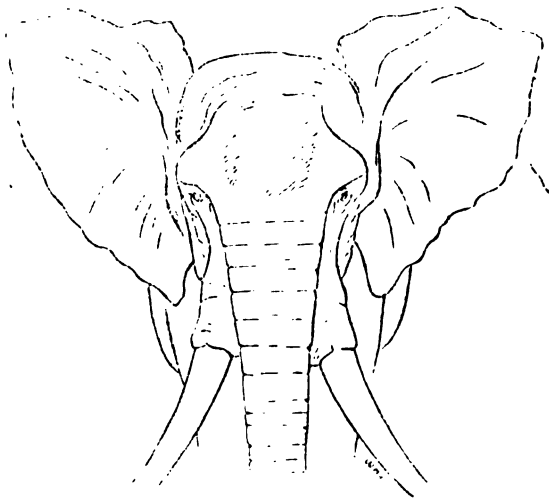
It is quite common to find in the skulls of slain elephants the marks where bullets have passed through the honeycomb-like mass of bone which surrounds the brain, and where the damage has been repaired by Nature. There are several such specimens in the College of Surgeons.

If the African elephant cannot be induced to turn his side towards the hunter, the only hope of the latter is to aim at one of the legs so as to disable it.

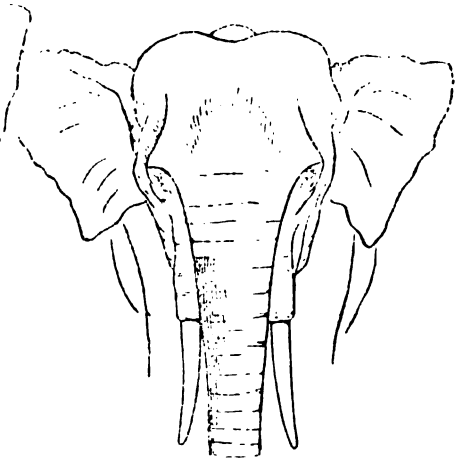
The late Gordon Cumming once owed his life to an accidental shot which broke the elephant's leg and rendered it powerless. As it could not stir, he, knowing very little of anatomy, tried to find its vulnerable points by shots at short distances. After receiving with comparative indifference ball after ball, it sank dead from a shot which took effect between the eye and ear.

He incurred much blame for the heartless cruelty of this proceeding, but in reality he saved pain to hundreds of other elephants, not to mention human lives.

It was far more humane to learn how to kill an elephant instantaneously with a single shot, than to allow the animals to be caught in pitfalls and transfixed by a stake, or to be slowly tortured to death by countless spear wounds.



African Elephant.



Asiatic Elephant.

Also, with the flesh of the elephants he fed whole tribes of starving natives, and so he brought the ivory into the market with the least possible pain to the animals, and the greatest possible good to the various native tribes, which depend largely on the elephant for their subsistence.

Section of Skull of Elephant.

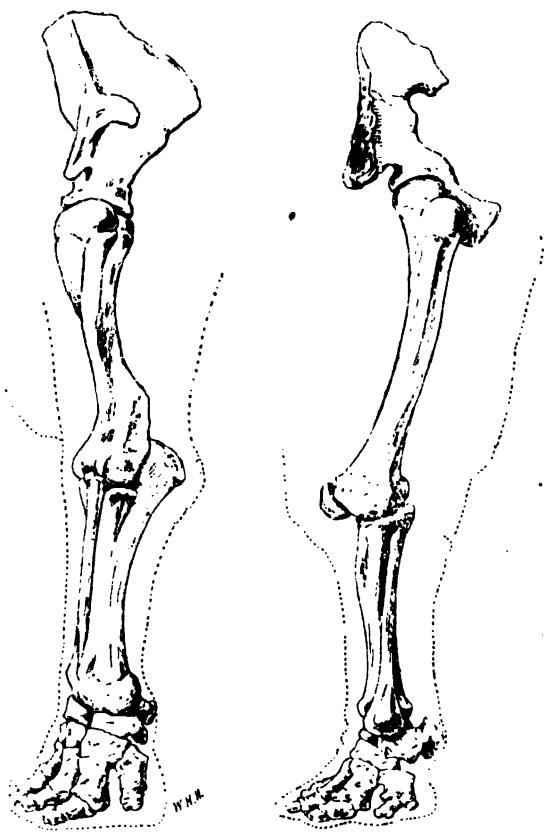
Both species have a similar gait. When they walk they do not, like the horse, move the feet alternately and diagonally, but walk alternately with the feet of each side.

Moreover, instead of bending the leg at the so-called "knee" and "hock," as the horse does, and furthermore bending it again at the pasterns, the elephant scarcely bends its legs at all, but swings them forwards and backwards, planting the heel first on the ground, just as man does. In fact, the

elephant is, in our modern athletic slang, "a fair heel and toe pedestrian."

A glance at the skeleton will show the reason for this gait. In the elephant, the "cannon bones," or "shank bones," *i.e.*, the middle metacarpal bone of the fore foot and the middle metatarsal bone of the hind foot are not lengthened as in the horse, and the entire foot is brought close to the ground, all five toes resting on it.

This peculiar structure of the legs enables the elephant to use them as offensive weapons. It does not kick with its hind legs like the horse, nor strike, boxer fashion, with its fore-feet, like the stag, but it hustles its foe backwards and forwards under its body, kicking it forward with the hind feet, and then



Fore-leg. Hind-leg.

backward with the fore feet. In this way it has been known to destroy a wild boar and a tiger, and in both cases the elephant was a female which was defending her offspring.

It is strange to see how artists ignore this structure, even when they are engaged in scientific work. I have now before my eyes a well-known zoological diagram for schools, in which the elephant has knee, hock, and pasterns just like a horse, and to make matters worse, is standing with the pastern of one hind foot gracefully bent!

I may here mention that the footprint of an elephant designates the size and serves to identify the animal.

It is found by measurement that twice the circumference of the foot is equal to its height at the shoulder. Now, the circumference of "Jumbo's" foot slightly exceeds five feet six inches, so that his height is a little over eleven feet.

The identity of the animal is shown by the lines which cross and recross each other in the sole of the elephant's foot, just as do the lines of the palms of our hands, and which are imprinted on soft ground. When hunters track an elephant, they copy these lines, and so are able to adhere to the "spoor" of the same animal, even when it has been mixed with the footsteps of many others.

These great feet, which can crush a tiger into a jelly, and which have to support a weight which is measured by tons, are as silent in their tread as those of a cat. All elephant hunters know that elephants can glide noiselessly through thick forests, where even the barefooted savage can scarcely tread without betraying his whereabouts.

Even upon the highroads of this country, where the shod hoof of the horse is audible far off, the elephant swings his mighty bulk along without apparent effort, and so silently that "the blind mole may not hear a footfall."

Huge as it may be, no creature is so difficult of detection. Dr. W. Knighton, the Cingalese elephant hunter, tells me that in the forests of Ceylon you may be standing within a couple of yards of a nine or ten feet elephant, and not be able to distinguish the animal from surrounding objects. Its legs are just like tree trunks, and its brown body merges so imperceptibly into the sombre forest shadows, that the eye is incapable of discerning it.

[Both species are playful, and are even fond of toys. In one case, a large wooden ball was given to the elephants. But they became so excited with their toy, hurling it about as if it were shot from a cannon, that the keepers were obliged to remove it.

Both species practise a most curious mode of avenging themselves when angered.

In Mr. Baldwin's work on African hunting, it is mentioned that fully half a mile from any water a tolerably large crocodile was found, hanging in the fork of a tree about ten feet from the ground. The natives seemed to be familiar with this strange position for a crocodile, and said that the reptile had been put there by an elephant.

They stated that when the elephants wade into the lake (Nyami) for bathing purposes, the crocodiles are apt to worry them and bite their legs. Sometimes, when an elephant is annoyed beyond all patience, it picks up the crocodile in its trunk, puts it among the branches of a tree, and leaves it there.

The truth of this curious story is corroborated by the behaviour of an Indian elephant, very inappropriately named Pangul, or Fool.

The animal knew perfectly well the weight of the burden which he had to carry, and if he were overloaded, either refused to stir, or shook off his load by wriggling his skin.

One day an officer was trying to overload him, and became so angry at seeing the load repeatedly thrown off, that he flung a tent-peg at the elephant. Pangul took no notice at the time, but a few days afterwards he met his persecutor alone. Pangul immediately picked him up with his trunk, put him among the branches of a large tamarind tree, and left him there to get down as he could.

Gigantic as the elephant may be, it is horribly afraid of any small quadruped. A kitten which happened to stray among some elephants drove them half mad with terror, occasioning as much unreasonable consternation as a cockroach or mouse in a drawing-room full of ladies.

Yet, an elephant has been known to take a fancy to a cat, or rather, the cat took a fancy to the elephant. She had a fixed idea that his back was a sleeping-place expressly designed by nature for her, and on his back she *would* go. At first, the elephant took her off his back and put her out of his cage, but as fast as he put her down in front, she slipped round and climbed up his hind quarters again. So the elephant let her have her own way, and soon became quite attached to the cat.

The reader may remember that I have alluded to the assistant male elephants which play the part of the Philistines to the captive Samson, just as the koomkies take the part of Delilah.

These assistant elephants are as carefully trained to fight as our modern boxers, and, as with man, size and brute strength are of small avail before practised skill. The professional fighting elephant knows beforehand every move in the game,—when to bump his antagonist against a tree and thrash him on the neck with his trunk before he can recover from the shock, when and how to use his tusks, and when to charge with his whole weight against his adversary.

Some of these trained elephants have been sent to Africa for the double purpose of capturing African elephants and of showing the more intelligent tribes how to take elephants alive instead of merely killing them for the sake of the ivory.

The account of their transit is a very interesting one, but too long to be given in full. There was much the same difficulty in embarking them as was found with "Jumbo," but there was much more difficulty in landing them.

Owing to the peculiar shore of Zanzibar, the ship could not approach within two miles of land. At last it was decided to lower one of them, poetically named "Budding Lily," into the water, and induce her to swim ashore.

So she was slung over the side, and let gently into the sea, with the mahout on her neck. Now elephants, when bathing, are rather fond of playing a practical joke on the mahout. They sink themselves beneath the water so as to give the mahout a sound ducking, while they can breathe through the end of the proboscis, which is held out of the water.

"Budding Lily" played this same joke, but when she rose to the surface became alarmed and tried to scramble on board again. The captain of the ship sent a boat, which tried to tow the elephant landwards, but the animal was too strong, and dragged the boat back to the ship's side, up which it vainly attempted to climb.

After more than an hour had been thus wasted the elephant suddenly comprehended the situation, and swam towards shore, accompanied by the boat. Some sand-banks on the way afforded it resting places, and in about four hours after leaving the ship the first Asiatic elephant set foot on African shore.

There was little trouble with the other elephants, for they took courage from the conduct of their companion, and swam ashore after her.

One of the elephants of the Jardin des Plantes, of Paris, used to play an absurd trick with the visitors. She would sink herself until only the tip of the trunk projected from the water, and she was thereby rendered practically invisible. Then she would send a torrent of water over the spectators, who could not imagine where the deluge came from.

That elephants should be such admirable swimmers seems very remarkable, and especially that they should have such propulsive power as to drag back a boat fully manned. The capability of sinking or rising at will in the water is equally remarkable, and is owing to the power of contracting its body so as to render it heavier than an equal bulk of water.

Activity, again, seems no characteristic of the elephant. Its apparently stiff and ungainly legs, which can swing some fourteen or fifteen feet at each step, although well enough adapted to carry the huge body along at a swift pace, appear to be totally inadequate to perform feats of activity.

Yet the elephant can climb rocks where one might think no animal but the goat would venture. It can slide down a steep hill just as a "coaster" slides down a snow-clad declivity on his sledge, and can guide or check its progress with equal skill. I have seen an elephant stand on its hind feet, or fore feet, or on the feet of one side, or on the fore foot of one side and the hind foot of the other, and all the time mounted on a wooden cylinder not large enough to support all its four feet when placed together.

Yet, though it can swim so well, and can so easily ascend and descend precipitous slopes, the elephant is utterly powerless in mud of any depth. Should it by chance stray into a quagmire it becomes frantic with terror, utters screams of mingled fear and anger, its eyes start from its head with fright, and its proboscis feels in all directions for something firm on which it may stand.

When an elephant is in this predicament, the mahout slips off over the animal's tail, and runs away as fast as he can. Did he not escape in this way, the elephant would be sure to pluck him from its neck, and place his body under his feet so as to form a support for its weight.

The only plan by which an elephant can be relieved from its awkward position is to approach as near as is consistent with safety, and to throw logs, planks, or branches of trees within reach of the proboscis. The elephant immediately seizes them, and places them one by one under its feet until it can stand firmly, and by continuing the process, makes a road by which it may regain dry ground. As soon as it has done so, the mahout resumes his place on the animal's neck, and can safely guide it as before.

Cautious as is the elephant in trusting its vast weight to anything which may seem to be unable to support it, the animal's wonderful power of balance enables it to step for almost incredible distances from one foothold to another.

First, it surveys the intervening distance, and carefully takes the measure of it. Then it leans forward, and stretches its proboscis forward so as to test the strength of the next foothold. Guided by the proboscis one fore foot is then pushed forward until it obtainst a hold.

Next follows the hind foot of the same side, and then the fore and hind feet of the opposite side are gradually transferred to their new situation, the ever restless proboscis always acting as pioneer of each step.

No one who has not seen it can realize the marvellous delicacy of the whole proceeding, or the perfection of balance shown by the apparently ungainly animal.

Judging by appearances, the elephant is about the last animal in the world which we should have thought to be swift of progress on land and in the water, a rock-climber, silent of tread as a cat, almost

invisible among trees, and capable of slipping through dense forests without shaking the boughs or producing a sound that would betray its presence. Still less could we expect that it should be able to perform the extraordinary feats of agility which have already been mentioned.

Yet it does all these things, and, most wonderful of all, its vast strength, its powers of intellect, and its other great gifts are made to be subservient to man.

I was never more impressed with the truth of the passage quoted at the beginning of this article, than by watching the mode in which the enormous animal was rendered helpless by man, into whose hand all living creatures are delivered.

(To be continued.)

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.—(*dictated*).

409	
63	
780	
5	462
110	290
Ans. 1367	Ans. 172
4070503	925
4	319
$162^{3}2012$ Ans.	Ans. 606

Steam, Water, Drink, Postman, Penny, Eyes.

STANDARD II.—(*dictated*).

In a school there are 18 long desks and 6 short ones. In each long desk there are 7 girls, in each short desk there are 5 girls. How many girls are there in the school? Ans. 156.

	4095
	510
	29000
39407	69015
16526	39
Ans. 22881	Ans. 102659
	58673
4)23561	39
Ans. 5890—1	Ans. 2288247

STANDARD III.

(1) I sell 25 shillings' worth of eggs at 13 for a shilling and have still 27 left. How many had I at first? Ans. 352.

(2) Divide one hundred and nine thousand and forty-nine by one hundred and sixty-seven.

Ans. 652—165

(3) Take four hundred and nine pounds thirteen shillings and tenpence farthing from ten thousand and thirty pounds ten shillings and ninepence.

Ans. £9620 16s. $10\frac{3}{4}$d.

(4) Add together four hundred pounds thirteen shillings and sixpence, ten shillings and one halfpenny, nine shillings and elevenpence farthing, fifteen thousand and fifty pounds twelve shillings and sixpence, sixty pounds ten shillings and fourpence, eight thousand nine hundred and sixty-seven pounds seventeen shillings and eightpence three farthings, and four five-pound notes. Ans. £24,500 14s. $0\frac{1}{2}$d.

(5) In a cricket club 17 boys paid 6d. each. They collected also £1 1s. 6d. They paid for wickets 5s. 6d., bats 12s. 6d., and balls 3s. 6d. How much had they left? Ans. 8s. 6d.

STANDARD IV.

(1) What change would a man have out of a £5 note if he bought 17 railway tickets at 2s. $9\frac{1}{2}$d. each? Ans. £2 12s. $6\frac{1}{2}$d.

(2) Divide eighty thousand and four pounds and ninepence three farthings by seventy-nine.

Ans. £1012 14s. $2\frac{1}{4}$d.

(3) How many ounces are there in 1 ton 11 lb.? Ans. 36,016 ozs.

(4) Find the number of square inches in 13 square yds. 3 sq. ft. Ans. 17,280.

(5) Find the total amount of a collection if the box contains 17 half-crowns, 29 florins, 59 shillings, 116 sixpences, 47 fourpenny pieces, 100 threepenny pieces, 1080 pence, and 520 half-pence.

Ans. £18 9s. 10d.

STANDARD V.

(1) If a boy cuts 200 corks in 45 minutes, how long will it take him to cut 360 of the same size?

Ans. 81 mins.

(2) A man buys 3 lbs. 8 oz. of tea at 1s. 11d. for a lb. and a quarter; how much does he pay?

Ans. 5s. $4\frac{2}{5}$d.

(3) I buy 250 engravings at 10s. 6d. each, and frame them at a cost of 3s. 11d. each. If I sell each framed picture for a sovereign, find my gain.

Ans. £69 15s. 10d.

(4) Find price paid for a field of 3 rd. 35 per. at 100 guineas an acre. Ans. £101 14s. $4\frac{1}{2}$d.

(5) Bill: $25\frac{1}{2}$ lb. of sausage at 7d. per lb.
250 cans Australian mutton at 1s. $11\frac{1}{2}$d.
$\frac{1}{2}$ cwt. potted meat at 6d. per lb.
13 doz. tins salmon at $7\frac{3}{4}$d. per tin.
4 lb. 4 oz. ham at 1s. per lb.

Ans. £31 17s. $5\frac{1}{2}$d.

STANDARD VI.

(1) How many candles, each weighing $1\frac{2}{9}$ oz., are contained in $3\frac{2}{3}$ cwts.? Ans. 5376.

(2) Take 9 thousandths from 1, and divide the remainder by ·0025. Ans. 396·4.

(3) What decimal is $1\frac{3}{5}$d. of 3s. $1\frac{1}{2}$d.?

Ans. ·0426.

(4) A butcher has a sirloin of beef weighing $20\frac{3}{4}$ lbs. He cuts off $6\frac{1}{8}$ lbs., and sells it for £$\frac{1}{4}\frac{1}{8}$; what would he sell the remainder for at the same rate?

Ans. 9s. 3d.

(5) Ten men work 8½ hours a day for 9 days in making a road. How many men would do it in 9 hours a day, working 5 days? Ans. 17.

Domestic Economy.

STAGE II.

(1) What are the constituents of carbonic acid gas? Show how men and the vegetable kingdom respectively require different kinds of air for their nourishment; and explain how a balance in the atmosphere is thus kept.

(2) What is ventilation? Explain the different methods of ventilating a room, and state which you prefer, and why.

(3) Describe the process of digestion and show how the body is kept in repair by food. What food will especially be required to prevent the bones of a child becoming soft and rickety?

(4) What food contains in itself all the constituents required for nourishment? How much food does Dr. Lankester say that a healthy infant of six months old and a strong man will respectively require in the course of the day?

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(1) To what machine would you liken the body and the food which enters it? Explain particularly how force is produced.

(2) Explain why a room, which is crowded with persons, becomes unhealthy.

(3) Name the different kinds of food.

(4) What is dust? Give some methods for dusting. How would you dust a room so that the dust shall not remain in it?

STAGE III.

(1) Describe breadmaking.

(2) How would you treat a person who was burnt or scalded?

Physical Geography.

STAGE II.

(1) Explain the cause of land and sea breezes.

(2) What do you mean by 'Saturation' and 'Dew Point'? Explain Hoar Frost.

(3) What is an ordinary basin like? How would you describe the map of a basin? Draw and describe the basin of the Tyne.

(4) What is the composition of the air, and in what proportions? Are there any minor constituents?

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(1) How is it that trade-winds do not move exactly from north to south or south to north?

(2) Where does the water in the rivers come from? Why do we talk about water circulation?

(3) Explain why it is that there is more dew on a clear night, and also more dew in an open place than under a tree.

(4) Explain the effect of heat on vapour or air. Also the effect of cold.

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

NOT one of the least of the difficulties a teacher of elementary science has to contend with, is to and himself supplied year after year with the same old charts, or so-called 'illustrations of natural philosophy.' Very ancient ideas of science are here illustrated. 'Solidity' is represented by a nail stuck into a piece of wood. 'Liquid displacement' by a block of stone in a vessel of water, without any attempt to show the relation between the size of the block and the quantity of water displaced. Then we have duly pictured all the old nonsense about centrifugal and centripetal forces. Finding these two latter terms on the chart, an inquisitive boy asked what they meant. One of his companions in the class volunteered an explanation; and gave as the 'cause' of the moon's revolution about the earth, the joint action of these two forces. The boy, in point of fact, gave expression to the popular notion, viz., that the moon is kept from flying *away* from the earth by the centripetal force, and kept from being drawn *to* the earth by the centrifugal force. The boy, like a good many others, had been taught to think this a full and sufficient explanation. He believed he quite understood *why* the moon revolved about the earth. Now, in reality, there are no such forces as are here spoken of. They are mere creatures of the imagination. Man in the early stages of intellectual growth solves all problems by referring to a God. I was once busy in the chalk tunnel at Riddlesdown, digging out a beautiful shell, the 'lima spinosa.' A very affable man who had been watching me said, 'Ah, you geologists think you know all about how those shells came there.' 'Yes,' said I, 'we think we *do* know something about it.' 'But you don't,' said he. 'Indeed,' I rejoined, 'do *you*?' 'Yes,' he replied, 'God put them there at the creation, and you'll never get any further than that.'

In like manner I observe in the present day a growing tendency to refer all phenomena to the operation of some one or other 'invisible force.' What people mean when they talk of 'centripetal force,' in the case of the moon's revolution, is simply its tendency to fall *to* the earth, *i.e.*, its gravity. And by 'centrifugal force' they mean the tendency of the moon to continue its motion in a straight line, *i.e.*, its inertia. If the gravity were greater than the inertia, the moon would fall *to* the earth; if the inertia were greater than the gravity, the moon would quit the earth altogether. We are, as I have said before, unable to say anything about the causes of gravity or inertia; these are simply names of observed tendencies. We neither understand nor can explain their causes, and those are no whit better off who think they have entirely settled the thing by diving into the depths of their imaginations and bringing up the forces centripetal and centrifugal.

The following is the outline of a lesson on 'Liquid displacement,' a subject to which I devote four lessons. This is the first :—

Smith, do you remember that I found one of the ink-wells too full yesterday—in fact, it was all but running over? Ans.—Yes, sir, but I don't think I filled it like that, some one must have put some more ink in after I left it. (A boy)—It was Adams, sir. Adams! what have you been doing? Ans.—(Adams) I put some peas in. Why? Ans.—Please, sir, this boy, Eve, gave me the peas and told me to do it. Very well, then I shall have something to say to you both after the lesson; but *now* I will ask one or two questions about it. Was the ink-well so full before the peas were put in? Ans.—No (from Smith), it was only half-full. Was there any more ink in after Adams put the peas in than before? (No answer.) Did Adams put any ink in? Ans.—No, sir, there was just the same quantity. Then what made the ink rise to the brim? Ans.—Because the peas were in. But why should *that* make it rise? Ans.—Because the peas took up room. (A boy)—You told us all about that a long time ago. In my exercise book I have written, 'No two things can occupy the same space at the same time.' (Another boy)—That's not quite right. I have 'No two portions of matter can occupy the same space at the same time.' Well, Jones, is not that all the same thing? Ans.—No, sir, because this is not true if the things are not matter. This room may be full of a great many different sounds all at the same time. What of that? Ans.—*One* of those sounds might be quite enough of itself to fill the room. Very good, Jones, then we are talking of matter only. Tell me what the fact that Jones has just read from his book has to do with the ink-well's getting so full? Ans.—The peas took up the space that was filled by the ink, so the ink was pushed away, and if Adams had put in any more peas, the ink would have run over. Very well, now look at these two glasses. This larger one will hold just a pint; it has a little lip or kind of spout at its rim for the water to run out when the jug is over-full. This smaller glass, you see, is square at the top and bottom, and is the same size all the way up. The bottom is exactly one square inch. You notice I have marked a scale of inches up one of the sides: five inches, you see, from the bottom to the top. Now I will pour some water in: there, I have poured in enough to rise one inch in the glass. Tell me how much water is in? Ans.—One inch, a cubic inch, a square inch. What do you mean, Drayson, by a square inch of water? Ans. (Drayson)—I meant a cubic inch? But why not a square inch? Ans. Because that would only just cover the bottom. (Another boy, Howell)—No, it wouldn't. A square inch is only surface: it says in my geometry book that surface is length and breadth only, no thickness, so that's nothing. What's nothing, Howell? Why, sir, if the water didn't have any thickness, there wouldn't be any water at all. (A boy, Drayson)—You can't measure how much water there is by square measure; that is a cubic inch of water in the glass. Just so, my boy, hence you should have thought before you spoke. Now I will pour some more water in: there, it has risen up two inches. How much water is in? Ans.—Two inches. What sort of inches? Ans.—Cubic inches. How much would this glass hold altogether? (A boy)—Please, sir, how many cubic inches would that pint glass hold? Ah! that is a point I did not intend to notice in this lesson. Do you particularly want to know, Smith? Ans.—Yes, sir, because I was thinking that you could easily find out. Indeed! How? Ans. (Smith)—See how many of those small glassfuls the pint will hold. Very well, Smith; as it is so easily done, come out and do it. (Smith fills the pint glass with six of the smaller.) Now stop. Is it full? Ans.—No, not quite. How many cubic inches are in now? Ans.—Thirty. Before you put in any more, Smith, I will place a glass under the lip to catch any that may run over. Now go on. There, when he was just finishing another five, it began to run over. Now pour what has run over into your cubic inch measure, and see how much there is. Ans. (Smith)—About half a cubic inch. Then how many cubic inches are in a pint? Ans.—Thirty-four and a half. Very good; are you satisfied, Smith? Ans.—Yes, sir. Then you may write on the board the fact you have discovered, and go to your place.

Look, boys! I have here two little cubes of lead, each exactly a cubic inch. I have put some thin wire round each block, so that I can hold up the cube by the wire. Brown, come here. The pint glass, you see, is full. Put the empty five-inch glass under the lip. Now take one of the little cubes and let it down gently into the water; look, boys! some water is running over. The little block is now quite immersed. Brown, look at the measure; how much has run over? Ans.—Exactly a cubic inch. Very well; now put the other cube in. How many cubic inches of lead are in the water? Ans.—Two. And how much water has been displaced? Ans.—Two cubic inches. Good. I will now take one of the cubes, and, with this hammer, beat it all out of shape. There, would you call it a cube now? Ans.—No, sir. What shape would you call it? Ans.—It has no shape. What word do you use for that which has no shape? Ans.—Shapeless. Yes, this is a shapeless mass of lead. (A boy, raising his hand)—Please, sir, you just said it wasn't a cube. Well, do you think it *is?* [Ans.—Yes, it's a cubic inch of lead just the same as before; you haven't taken any lead away. (Another boy)—It *is* a cubic inch of lead, but it is not a *cube*. (The previous boy)—How can it be a cubic inch if it's not a cube at all? Ah! stop a minute, boys. What sort of a mass did I just say this was? Ans.—A shapeless mass. Very well, then, it's without shape. Had it shape before I hammered it? Ans.—Yes. What was the name of that shape? Ans.—A cube. Then what is the word cube a name of? Ans.—Shape. When I wanted Brown to measure how much water there was in that glass, what terms did we use? Ans.—Cubic inches. Is the term 'cubic inches' the name of 'shape' or of 'measure'? Ans.—Of measure. Now how much lead is in this shapeless mass? Ans.—A cubic inch. Is it a cube? Ans.—No, sir, it has no shape. Can any boy come out here and prove before the class that this shapeless mass contains just a cubic inch of lead? (Several boys answer)—Yes, sir, I can. Eve, you may come out. (Eve comes out and dips the lead into the liquid, when it displaces a cubic inch.) Adams, what have I here in my hand? (Adams, looking embarrassed)—Some peas, sir. Come here, Adams: take this handful of peas and find how many cubic inches there are. Adams fills the pint glass with water, then puts in the peas, when about four cubic inches of water are displaced.) Ans.—Nearly four cubic inches. Very good. Now you can both go to your places. Can any boy tell me what

act we have really been proving this morning? (Nearly every boy in the class raises his hand)—Yes, sir, I can. Tell me what it is Ans.—When you put anything in water, the water that runs over is just as big as the thing you put in. (Another boy)—When you put a thing of a certain size in water, the bit of water that runs out is just the same size. (A boy, Howell)—Please, sir, that's rather silly. What's rather silly, Howell? Ans.—Why, to talk about a 'bit' of water; or water being as 'big' as something else. Well, what would *you* say? Ans.—I should say the 'quantity.' (Another boy)—I shouldn't say 'run over;' I should say 'displaced.' Very well; now I will write the fact on the board; but instead of using the words 'bigness,' or 'bit,' or 'size,' or even 'quantity,' I will use the word *bulk*; this, therefore, is what we have proved this morning:—'A body, immersed in water, displaces its own bulk of the liquid.'

(To be continued.)

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Scholarship Examination, 1882.

QUESTIONS WITH ANSWERS.

MALE AND FEMALE CANDIDATES.

Geography and History.

Three hours allowed for this paper.

All candidates must draw a map, and answer question 8. They may answer *four* other questions in each subject.

Geography.

1. Draw a map (showing physical features only) of—(*a*) Ireland, *or* (*b*) North America, *or* (*c*) Hindostan.

2. Explain the terms cardinal points, horizon, meridian, plateau; give the difference in time, and the distance between two places situated on the equator in longitude 40° E. and longitude 40° W. respectively, and state the latitudes of London, Edinburgh, Dublin, and Liverpool.

Cardinal points.—The chief points of the horizon are called cardinal points; and are named North, South, East, and West.

Horizon.—The horizon is the line where the sky and earth seem to meet.

Meridian.—A great circle passing through the poles, and cutting the equator at right angles.

Plateau.—An elevated plain or tableland.

40° East and 40° West represent a distance 80° apart; reckoning 60$\frac{1}{6}$ English miles to a degree, this would mean a distance of (60$\frac{1}{6}$ × 80) 4,808 miles.

The earth turns on its axis once in twenty-four hours or (360° ÷ 24) 15° per hour. A difference of 80° represents a difference of time of (80 ÷ 15) five hours twenty minutes.

The latitude of London is 51° 31′ N.; of Edinburgh, 55° 57′ N.; of Dublin, 53° 21′ N.; of Liverpool, 53° 24′ N.

3. Name four counties in England, Scotland, and Ireland resoectively, which are rich in minerals; and give a full account of one of the border counties of England or Scotland.

England; Northumberland, Durham, Devon, Cornwall.
Scotland; Lanark, Renfrew, Fife, Ayr.
Ireland; Kilkenny, Cork, Donegal, Galway.

Northumberland is one of the border counties of England, and lies between the Tyne and Derwent on the South, and the Tweed and Cheviot Hills on the North. It is separated on the West from Cumberland by the Pennine Range, and is washed on the East by the North Sea. It covers an area of 2000 square miles, and is seventy miles long from N. to S., and fifty from E. to W. Its surface is diversified; in the N., W., and S.W. it is hilly, sloping gradually to the German Ocean. The soil is fertile, producing corn and other agricultural produce in abundance, and the hills provide excellent pasturage for sheep, a peculiar breed of which is named from the Cheviot Hills. It is watered by the lower course of the Tweed, by the Aln, Coquet, Wansbeck, Blyth, and the Tyne; and several sheets of fresh water receive the name of the Northumberland lakes. Its coast is seventy-five miles long, and is rocky and dangerous, Lindisfarne, or Holy Island, the seat of an ancient monastery and bishopric; Coquet; Farne Islands, the scene of Grace Darling's bravery; and St. Mary's Island being near it. Northumberland has one of the largest coalfields in the world, and its S.E. part is covered with large numbers of colliery villages and towns, Blyth, Morpeth, Bedlington, Cramlington, Dudley, Ashington, Killingworth, and Seghill, being among the number. Its large towns also depend largely upon the export of minerals, and the manufactures dependent upon them for their prosperity. These towns comprise Newcastle-on-Tyne, a port, and noted for its manufactures of steam-engines, cannon, chemicals, iron goods, and glass; North Shields, noted as a port, and for its ship-building and iron-foundries; Hexham, the capital of the agricultural district, and Alnwick, Wooler, Berwick, Blyth and Morpeth. Numerous ruins of castles (Warkworth, Norham, Tynemouth, Dunstanburgh, Bamboro') and several noted battlefields (Flodden Field, Otterburn, Hexham, and Hedgeley Moor) attest its later historical importance, while the remains of Hadrian's wall and the names of several places show its connection with earlier English history. The accompanying sketch map marks the chief places of interest.

4. Describe a coasting voyage from Southampton by way of Lisbon to Constantinople, taking in cargo at six of the principal ports on the northern shores of the Mediterranean Sea.

Sailing from Southampton Water we pass westwards through the Solent, and rapidly steam into the English Channel, leaving the Needles on our left. Steering now S.W., we soon sight the island of Ushant, off the N.W. coast of France, and, prepared for a rough voyage, make for Cape Finisterre, a bold headland in the N.W. of Spain. Passing by Oporto with its stores of wines, our first calling station is Lisbon. Here we discharge a portion of our cargo of manufactured goods, and as the ports to which we are sailing are pretty well supplied with fruits, receive only as freight some tons of salt and bales of cork. Our way now lies past St. Vincent and Trafalgar, ever memorable in British warfare, through the Straits of Gibraltar, eastwards into the Mediterranean. Skirting the coast of Spain, and passing the ports of Cartagena, Valencia, and Barcelona, we call at Marseilles. Here we discharge some of our coal, and take instead silk goods, wine, and brandy. Leaving Marseilles we call at Genoa, once one of the greatest commercial cities in the world, and still having upwards of 100,000 inhabitants, taking in manufactured silk goods; then at Spezzia for some of its famous marble; then at Leghorn for hats; then pass along the coast of Italy to Civita Vecchia, the port of Rome, having seen Elba, the place of Napoleon's banishment for a short time, on our way. Here we leave more of our manufactures, and some of the French brandy, taking instead raw silk and marble. Naples is our next port of call, and our manufactured goods are lessening rapidly, brimstone and marble taking their place. We have now a long sail before us, as we are bound for Venice, at the head of the Adriatic. Stromboli is very active as we pass, and without fear either of Scylla or Charybdis, we pass through the straits of Messina, round the cape and northwards into the Adriatic. Venice retains many signs of its former greatness, but these are unnoticed in our haste to land more of our home manufactures, and take in Venetian wines, rice, silk, and cheese. We have called at our last port, and sail southwards past the Ionian Islands, the south of Greece, through the Archipelago, into the Dardanelles, the Sea of Marmora, to the Golden Horn of Constantinople, where our charter says we are to discharge the whole of our cargo.

5. Enumerate the chief productions of Trinidad, Victoria, and Ceylon, and give the dates at which these possessions were severally annexed to the dominions of England.

Trinidad.—Taken from Spain in 1797. Productions: sugar, molasses, rum, cocoa, and spices, including cloves, nutmegs, pepper, ginger, vanilla.

Victoria.—Discovered in 1802; settled in 1835; and became a separate colony in 1850. Productions: gold in large quantities, tin, iron antimony: wool, tallow, hides, are also exported.

Ceylon.—Coast provinces became British in 1796. The whole island became a crown colony in 1815. Productions: coffee, cinnamon, cocoanut (nut, oil, and fibre), rice, spices, precious stones.

6. Describe the positions of Cyprus, St. Helena, Borneo, Barbadoes, and Vancouver's Island, and give a full description of one of these islands.

Cyprus.—An island in the Levant 60 miles from the S. coast of Asia Minor, 35° N. lat. and 33° E. long.

St. Helena.—An island in the S. Atlantic, 1200 miles from the coast of Africa, 16° S. lat. and 6° W. long.

Borneo.—A large island S.E. of Asia; the district visited by British is in N., about 3° N. lat., and 114° E. long.

Vancouver's Island.—W. coast of N. America; 50° N. lat. and 125° W. long.

St. Helena has an area of 47 sq. miles, and is a high table-land bounded by precipitous cliffs, which are in many cases upwards of 1,000 feet high. In these cliffs there are numerous inlets, but all are inaccessible except those on the north-west. On one of these stands James Town, the capital and port of the island. It has a healthy climate, although it is within the tropics, and is of considerable importance to this country. It is a calling station for vessels from India which take the Cape route, and also a station for the vessels of our navy which cruise on the west coast of Africa. From 1673 to 1833 it was in the possession of the East India Company. In 1815 it became Napoleon's home and his place of sepulture in 1821. It is the see of a bishop, and has a population of about 70,000.

7. Name the mountains in which the Rhine, Volga, Mississippi, Amazon, Indus, Lena, and Niger rise, the seas into which they flow, and a few of the principal cities on the banks of the four first-named rivers.

RIVER.	SOURCE.	TOWNS ON BANKS.
Rhine.	Mt. St. Gothard, Alps.	Amsterdam (Amstel), Leyden, Utrecht, Arnheim, Cologne, Coblenz, Carlsruhe, Strasburg, Basle, Schaffhausen, Constance, Liechtenstein.
Volga,	Valdai Hills.	Astrakhan, Saratov, Nijni-Novgorod, Moscow, Samara, Kasan, Tver.
Mississippi.	Mississippi proper, in Lake Itaska, Minnesota, west of Lake Superior; Missouri, in Rocky Mts.	St. Paul, St. Louis, Memphis, Vicksburg, New Orleans; Jefferson City, Pittsburg, on tribs.
Amazon.	Andes.	Macapa, Barra, Obidos.
Indus.	Himalaya Mts.	
Lena.	Altai Mts.	
Niger.	Kong Mts.	

History.

8. Arrange in chronological order and give the dates of the following events:—The accession of George III., of Edward I., and of James I.; the battles of Culloden, La Hogue, and the Standard; the passing of the Act of Uniformity, the Septennial Act, and the Habeas Corpus Act; the deaths of Nelson, Wallace, Mary Queen of Scots, and Pitt.

Battle of the Standard	1138
Accession of Edward I.	1272
Death of Sir Wm. Wallace	1305
Death of Mary Queen of Scots ...	1587
Accession of James I.	1603
Act of Uniformity passed	1662
Habeas Corpus Act passed	1679
Battle of La Hogue	1692
Septennial Act passed	1716
Battle of Culloden	1746
Accession of George III.	1760
Death of Pitt, Earl of Chatham ...	1778
Death of Nelson	1805

9. Give a brief account of the conquest of Britain by the Romans; and name any distinguished Romans who died in this country.

The first real invasion of England took place in 55 B.C. and the following year. Tribute was exacted, but the Britons were left alone till 43 A.D., when Aulus Plautius was sent to this country by the Emperor Claudius. He succeeded in subduing the country south of the Thames. In 50 A.D., Caractacus, a British chief, was defeated and sent prisoner to Rome. Missionaries from Rome introduced Christianity into the island from A.D. 58 to 61, while in 61, Boadicea, the queen of the Iceni, the British tribes occupying Norfolk and Suffolk being defeated, poisoned herself. Julius Agricola was Governor from 78 to 84, and during these years he extended the conquest to the Firths of Forth and Clyde, fortifying his positions as he went, and for safety erecting a wall between these arms of the sea. The policy of the Romans was to civilize the people, to build towns, make roads, and enlarge the resources of the country The emperor Hadrian visited the country in 121, and built a wall from the Tyne to the Solway. The emperor Constantine died at York in 306 and Severus in 211; Carausius also died at the same town in 297.

10. Enumerate, with dates, the chief events of the reign of Henry III., and give a brief sketch of that monarch's character as illustrated by the events of his reign.

Ratification of the Great Charter	1216
Defeat of Louis at Lincoln	1217
Henry succeeded to power	1223
French war	1225
Second expedition to France	1242
Meeting of Mad Parliament and passing of Provisions of Oxford	1258
Simon de Montfort defeated the King at Lewes	1264
Shire and borough representatives sent to Parliament	1265
Battle of Evesham	1272

Henry was free from the cruelty and vice of his father, but was too weak to be a successful ruler in the stormy times in which he lived. His weakness led to both expeditions to France, and his ease and love of spending money in pleasure prevented these expeditions from being successful. His incapacity for government is shown by the fact that the "Mad Parliament" took the power from him, and by the growth of the power of Parliament.

11. Write a short life of one of the kings who reigned in Scotland during the sixteenth century, and explain the claim of the house of Stewart to the throne of Scotland.

Mary, Queen of Scots, was the daughter of James V., and succeeded to the throne while an infant. To prevent a marriage with Edward VI., she was sent to France, where she married the Dauphin. On his death she returned to Scotland, in 1561. Educated as a Romanist, her habits angered the Scotch, roused to great enthusiasm for Protestantism by the preaching of John Knox. She married Lord Darnley, and by this means alienated the Earl of Moray. Darnley was estranged by her favouritism for Rizzio, and led the nobles who murdered him. In 1566 James VI. was born, and his birth was immediately followed by the death of Darnley, and Mary's marriage with Bothwell, who was strongly suspected of being his murderer. The nobles rebelled, and Mary was confined in Lochleven Castle. Thence she escaped, and after being defeated at Langside, she fled to England, where she was virtually a prisoner for eighteen years. For alleged complicity in plots against Elizabeth, she was beheaded at Fotheringay Castle, 1587.

The Stewarts' claim to the throne of Scotland was based on the fact that Robert II., the first of the line, was the son of Marjory Bruce, daughter of Robert Bruce. David, her brother, left no issue, and as she had married Walter, the Steward of Scotland, her son was the nearest heir, and succeeded to the throne.

12. Name the principal English statesmen in the reigns of Henry VIII. and Elizabeth, and write a brief life of one of them.

Cardinal Wolsey, Thomas Cromwell, Sir Thomas More, William Cecil (Lord Burleigh), Earl of Leicester, Earl of Essex, Sir Francis Walsingham.

Thomas Cromwell was the son of a prosperous blacksmith and brewer at Putney. He received a liberal education, and on his return from the Continent became a lawyer. In this capacity he attracted the notice of Wolsey, who employed him in the work of the dissolution of the monasteries. On the fall of Wolsey he retired to Esher, but soon returned to London, and as a Member of Parliament succeeded in defeating a bill of impeachment against Wolsey. He became a member of the Privy Council, and the instrument of Henry's extortions, as well as furthering his divorce with Catherine. Having considerable

leanings to the Protestant party, he urged a marriage with Anne of Cleves. When she arrived, Henry was greatly disappointed, and Cromwell lost favour. In a very short time he was arrested, proceeded against by bill of attainder, and executed for high treason, 1540.

13. Enumerate the chief events of the years 1688-9, and state briefly the constitutional changes which resulted in England.

Trial of the Seven Bishops; request of the nobility for the help of William of Orange; landing of William at Torbay; flight of James II.; meeting of the Convention, passing of the Declaration of Rights, and the acceptance of the English Crown by William and Mary; revolt in Scotland, ending in battle of Killiecrankie.

The constitutional changes resulting from the events of 1688-9 were that James was declared to have forfeited the Crown, and it was settled first on the children of Mary, then those of Anne, and, failing these, on William's children by any other wife, James's son being thus debarred from the succession. The quarrel between the people and the sovereign was effectually settled by its being clearly set forth that the king can alone neither make nor unmake any laws, and that the judges cannot be dismissed at the king's pleasure. Toleration was also secured for Dissenters.

14. Give some account of the causes of the War of American Independence, and mention in order the chief incidents of that war.

In order to obtain money to meet the expenses of the war with France and Spain (1763), proposals were made to tax paper used in America. Having no share in the government of England, the colonists refused to pay, and would buy no stamped paper. The Stamp Act was repealed, but shortly afterwards taxes were levied on tea, lead, glass, and paper. The Port of Boston was closed after cargoes of tea had been thrown overboard by some of the inhabitants. Petitions followed, and the quarrel lasted ten years. War broke out in 1775.

Chief Events:—

Battle of Bunker's Hill	1775
Invasion of Canada by Montgomery	1775
Boston evacuated	1776
Declaration of Independence	1776
Long Island and New York taken	1776
Capture of Philadelphia	1777
Surrender of Burgoyne at Saratoga	1777
Surrender of Lord Cornwallis at Yorktown ...	1781
Independence of States acknowledged	1783

15. Name sovereigns of France and Spain who were contemporary with Elizabeth, Charles II., and George III., and give a brief account of the foreign policy of Charles II.

England.	France.	Spain.
Elizabeth 1558—1603	Francis II. 1559—1560 Charles IX. 1560-1574 Henry III. 1574—1589 Henry IV. 1589—1610	Philip II. 1556—1598 Philip III. 1598—1621
Charles II. 1660—1685	Louis XIV. 1643—1715	Philip IV. 1621—1665 Charles II. 1665—1700
George III. 1760—1820	Louis XV. 1774 Louis XVI. 1789 Republic. Napoleon 1804—1815 Louis XVIII.	Charles III. 1788 Charles IV. 1788—1808 Ferdinand VII. Joseph Bonaparte 1814 Ferdinand restored 1814

Charles II. was always in want of money, and his foreign policy mainly hinged upon his ability to get it. He married Catherine of Portugal for her dowry, and sold Dunkirk to France for a small sum. In order to obtain command of the supplies he made war with Holland. He joined the Triple Alliance against France, but all the time was receiving pay from the French king. When this was known war was again made against Holland, which ended in the treaty of Nimeguen, 1678.

School Management.

Three hours allowed for this Paper and that on Music.

All the Candidates must answer Question 1, and may not answer more than *eight* other questions.

1. Write full notes on one of the following subjects:—

(1) Leather; (2) Mountains; (3) Joan of Arc; (4) A Railway.

(1) Leather.

Introduction.—Draw from children:—Necessity of clothing for different parts of the body, among others, feet; shoes made of leather; leather used for other purposes; then of different kinds of leather, and that leather is made from skins of animals.

What Leather is.—Skins of animals dried and prepared in different ways: of horse, cow, buffalo, bear, deer, sheep, goat, chamois, kid, calf. Strong skins made into thickest leather.

Manufacture.—Some children may have seen skins: *elicit* covered with hair outside, flesh and fat inside; these of no use and must be removed. Method of removing:—Skins placed in lime water, *unhairing* and *fleshing* knives then used, put into pits with oak bark and *tannin* (explain): gradually changed to brown colour. Now called *leather:* need *currying*—surface covered with oil, lampblack, tallow, to make pliable, and give black, smooth appearance.

Finer kinds of skins not tanned, but covered with alum and salt, then washed, dried, and made glossy on a cylinder.

Kinds of Leather and Uses.—

(*a*) *Thick leather*, for all heavy work, strong boots, machine bands, trunks, portmanteaus, etc.
(*b*) *Morocco*—bookbinding, purses, coach linings.
(*c*) *Roan*—bookbinding, slippers.
(*d*) *Russian*—bookbinding, purses.
(*e*) *Kid*—gloves, finer kinds of boots.
(*f*) *Calf*—books, boots, gloves.
(*g*) *Shamoy*—(wash leather; why?).

(Exhibit specimens of each kind, if possible, and elicit peculiarities.)

Whence skins obtained.—Animals having been named, children can name countries: Russia, Switzerland, Morocco, America, Cape Colony, India.

Where manufactured.—Bermondsey, Stafford, Walsall. (Show all places on map.)

(2) Mountains.

Introduction.—Notice locality in which school is situated: flat, hilly, very hilly, in valley, etc. Names given to high land: mountain, hill, down, etc.

Definition and Varieties.—Land rising considerably above the level of earth's surface.

Use map and show that some mountains are in

(*a*) *Ranges:* point out Andes, Himalayas.
(*b*) *Groups:* Cumbrian.
Or (*c*) Stand singly, *Isolated.*

And (*d*) Emit fire, smoke, etc.; *Volcanoes*: Hecla, Etna. Draw on blackboard, sections of mountains to show character of *slope*, which affects surrounding country, and give names *summit*, and *base*, with explanations.

How formed.—Speak of probable former state of earth, its cooling, and collapse of crust, and edges overlapping, with Andes as illustration, thus accounting for rocky western slope; also of effects of earthquakes and subterraneous fires.

Uses.—Illustrations must be given and the uses elicited:—

(1) As boundaries, *e.g.*, Pyrenees, Ural.
(2) As affecting climate, making country warmer or colder, moist or dry, *e. g.*, India, Scotland, North America, Africa.
(3) For sources of rivers.
(4) For minerals.
(5) Surface as pasturage, or for growth of trees.
(6) Add beauty to a country, *e.g.*, Scotland, Switzerland.
(7) Dividing nationalities.

"Mountains interposed make enemies of nations,
That had else like kindred drops been mingled into one."

(3) Joan of Arc.

Introduction.—A description of the state of France in the time of Henry VI.: the almost complete overthrow of Charles, and his intentions with respect to the kingdom. Then the siege of Orleans.

Who she was.—A servant at an inn in Domremi, a town on the borders of Champagne and Lorraine (point on map). At time of becoming known, twenty-seven years of age, used to manual labour, and a skilled horsewoman; pious and attentive to her religious duties. Real name Jeanne Darc.

What she did.—Thought about her country's wrongs, believed herself inspired, determined to rescue Charles.

Her plan.—Presented herself to governor of Vancouleurs, got herself sent to Charles, picked him out from crowd, told him a secret known only to himself, described a sword by which she

meant to assist him, raise the siege of Orleans, and crown the king at Rheims—English were superstitious, and allowed her to enter Orleans, from which she made sorties and caused them to raise the siege (explain), 8th May, 1429. Went with Charles to Rheims, where he was crowned 12th July. Would have then gone home, but Charles detained her.

What became of her.—Remained with army till 1430, when she was taken prisoner at Compiègne by Burgundians, and given up to Bedford. Tried for sorcery and heresy, and her courage failing, confessed her revelations were impostures. Burnt alive in Rouen market-place, June 14th, 1431.

Her character and the results of her work.—Brave, pious, and patriotic; her country's deliverer, superstitious as other people of the time, but careless of danger so long as needed by her country; modest, retiring, and unambitious for herself.

The enthusiasm she roused ultimately led to the loss of nearly all the British possessions in France and the reinstatement of Charles in the sovereignty of nearly the whole of the country.

(4) A Railway.

Introduction.—Desire to visit friends in distant part of country; easiest method by the railway.

Origin of Railways.—Story of Stephenson: tramways with wooden rails. First railways, Stockton to Darlington, and Manchester to Liverpool.

Formation of a Railway.—Country surveyed (explain), shortest, best, easiest, or most practicable route chosen: levels taken (name and show as many as possible of instruments used), plans made, sections shown: contract let (explain).

Navvies employed (origin of word); ground levelled, drains made, cuttings formed, and hollows filled up or bridged over; work going on in several places at once.

Materials used.—Sleepers (why?) of wood; *chairs* (why so-called?) of iron; *rails*, of steel or iron, joined by *fishplates*. (Draw on blackboard: show joint and holes made so as to allow for expansion or contraction by heat or cold.)

Parts of Railway.—Stations (for passengers, and goods); at either end called the terminus (get other words), *up* and *down* lines (why? and show which is *up* and which *down*); *sidings*, *depots*, *signals* with cabins.

Rolling Stock.—Engines, carriages, trucks or waggons.

Uses. (*a*) Easy means of transit for passengers and goods.
(*b*) Helps to commerce and trade.
(*c*) Add importance to a place for above reasons.

Note.—The above is amply sufficient for a lesson. Other points, as persons employed, method of working, prevention of accidents, etc., would make up another lesson.

2. Name in progressive order of teaching, the apparatus required for lessons in geography, and show how you would give a conception of scale and proportion in map-drawing to young children.

The apparatus required for lessons in geography arranged in progressive order would be:—A blackboard and its accessories, a box of sand, some soft clay, and a sheet of white paper, a globe, a map, and text book. This order is given on the principle that *illustration* should accompany verbal explanation, and that the eye should aid the ear in the acquisition of geographical facts.

Illustration would precede explanation. Reference to different kinds of portraits which all children have seen would be made, and the blackboard would be employed to compare similar objects. From these illustrations would be deduced the conclusion that the same object may be represented by different sizes of lines of which all objects are formed. Lines to represent a yard, a mile, a degree, and multiples of these would then be made, and these applied to the dimensions of maps of different countries.

3. State the chief points to be noticed in giving a lesson on 'a river,' with the order in which each point should be introduced to the class. Illustrate your answers by some English or Scotch river.

The situation of the school would determine the order adopted. If near the mouth of the river, a *sail up the river* would probably be taken; if near the source of the river, a *walk down the banks* would be preferable. If away from any river, then the method adopted would be to illustrate by a shower of rain falling, and the different streams noticed joining each other, and forming a current in the street. Reference would then be made to the *hills*, as the *source* whence most rivers flow, (resemblance to house-tops pointed out,) the *course* down the valleys into which they flow and the streams from each, the different *feeders* or *tributaries* (resemblance to different streams from streets.) The *banks*, *bed*, *basin*, and *mouth* would then be noticed in turn, together with the *towns* on its banks. The river Thames might be used as an illustration. Its source, the Cotswold Hills, its tributaries along the course eastwards, the Windrush, Evenlode, Thame, Colne, Brent, Lea, Roding, on left bank; Kennet, Loddon, Wey, Mole, Darent, Medway, on right bank; the towns Oxford, Reading, Windsor, Eton, Richmond, Brentford, London, Greenwich, Woolwich, Chatham, Gravesend.

4. What plan would you follow in giving a description of some famous battle? Illustrate your answer by the Battle of Flodden *or* Waterloo.

A description of the causes of the war, the different contending parties, and the situation pitched upon as the place of battle would be briefly given. The latter would be illustrated as far as possible by a plan on the blackboard. Then would follow the chief events of the battle, with instances of striking bravery, and the result of the battle would be given with the ultimate benefits accruing.

Example.—French Revolution and death of Louis XVI. caused declaration of war against France, which lasted nearly twenty-two years. Rise of Napoleon, and results of Peninsular campaign noted, and Napoleon's conquests in Austria, Germany, etc., ending in confinement in Elba. His escape, and battles of Ligny and Quatre Bras. Both armies quartered on two gentle slopes near the village of Waterloo; in the hollow between lay the farmhouses of Hougomont and La Haye Sainte, round which the battle raged most fiercely. Napoleon tried to break the British ranks by shot and shell, and charges of cavalry. Repulse after repulse took place, till at last Napoleon's Old Guard, hitherto unconquered, made a furious onset, but wavered when met by the rush of the British Guards, broke and fled, pursued by the Prussians, just arriving to aid the British. Abdication, flight, surrender, and banishment of Napoleon followed.

5. Write out brief heads of a first lesson in 'simple subtraction with a series of progressive examples.

(1) *Meaning of subtraction.—Taking one number from another.* (Numbers are supposed to be known. Ball-frame to be used. Subtraction to be dependent on addition when done mentally.)

(2) *Examples in which the subtrahend is unvarying.*

Place ball-frame before class, and take 1 from 2, 1 from 3, 1 from 4, etc., up to 10: 1 from 2 leaves 1 because 1 and 1 are 2, etc.

When these have been learnt, questions without the use of ball-frame should be given.

(3) *Examples in which the minuend is unvarying* should next be given and treated as part two. 9 from 10, 8 from 10, etc.

(4) *Examples with varying* minuend and subtrahend are next to be given, *e.g.*, 2 from 9, 5 from 8, etc.

(4) *Blackboard* and then slates to be used, and examples of a similar character to above to be given on slates. Numbers up to hundreds may be given, where the principle of borrowing does not occur, *e.g.*—

10	8	72	47	98	736	830	770
9	4	21	34	26	215	220	370

6. Write out two or three problems in mental arithmetic requiring the application of three at least of the compound rules.

(1) A woman went to market with a sovereign in her pocket. She bought 4lbs. of beef at 10d., 2lbs. of sugar at 6d., ½ lb. of cheese at 9d. How much change had she for her other purchases?

(2) The wages of a man are 5s. a day, of a boy half as much; how much less than five pounds would two men and two boys earn in a week?

(3) A labourer earned 4s. on Monday, 5s. 6d. on Tuesday, and 3s. 6d. on each of the other days of the week. He pays 2s. 6d. a week for rent, and 1s. for schooling for his children; how much is left for his other wants?

7. Make and explain diagrams to illustrate the following:—

$\frac{1}{2}(\frac{1}{2}-\frac{1}{4})=\frac{1}{8}$

$(\frac{1}{2}-\frac{1}{4})\div\frac{1}{2}=\frac{1}{2}$

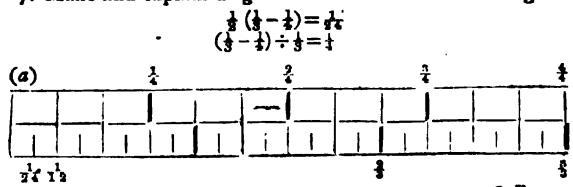


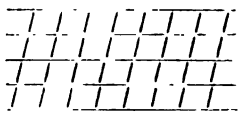
Diagram (*a*) shows that if a space be divided into three parts, and also into four parts, the difference between one of each of these parts is as much as one of the parts would be if the line were divided into twelve parts, and when one half of this difference is taken it is equal to $\frac{1}{12}$ of the whole space.

(*b*) The same illustration may be used.

$(\frac{1}{3} - \frac{1}{4}) = \frac{1}{12}$. To divide the whole line by 1 would give $\frac{1}{12}$, but of $\frac{1}{3}$ of the line $\frac{1}{12}$ is the fourth part.

8. Explain fully the principles of Mulhauser's method of teaching writing; and write the word 'trustfulness' according to that method.

Mulhauser's method of teaching writing is founded on the principle that aid should be given to the learner in determining the height, distance, and inclination of the separate parts of the letters of which words are formed. For this purpose lines are ruled horizontally and diagonally in the writing books, the distance between the horizontal and diagonal lines being the same. The horizontal lines determine the height of the letters, and the diagonal their distance and inclination.



Definite heights are given to the letters, thus *h b l* are a *height* above the line, *t* half a height above the line, and so on.

Letters which descend below the line are regulated in the same way.

When the inclination, heights of letters, and distances are learnt, the diagonal and the horizontal lines are gradually removed, and the style of writing acquired is symmetrical, regular, and free.

9. Detail some of the advantages and disadvantages of teaching reading by the Alphabetic method.

The advantages claimed for the alphabetic method of teaching reading are that the correct form of spelling the word is learnt at the same time as the sound of the word which it represents; the analysis of a word into its component parts compels the eye to linger longer over the words, and the form is the better impressed on the memory, and ability to recall the sound is rendered greater the next time the word presents itself.

The disadvantages are that the same sounds of the letters are not always used in the words; that having to pay attention to the *parts* prevents the learner from attending to the whole word-sign; that progress is retarded by the child being able to revert to this method of spelling, and effort is not put forth to retain the sign; that it does not practically assist spelling, for the power to repeat words at sight does not depend upon spelling but upon frequent reading.

10. Define a 'sentence' in grammar, and illustrate your definition by original examples of simple, complex, and compound sentences relating to events in English history.

A sentence is the expression of a complete thought. When the sentence contains but one subject and predicate it is called a simple sentence.

When it contains, besides the principal subject and predicate, one or more subordinate clauses with subjects and predicates of their own, the sentence is called complex.

When two or more simple sentences are united by conjunctions the sentence is compound.

Simple.—William, Duke of Normandy, defeated Harold.
The Battle of Waterloo was fought in 1815.

Complex.—Harold hastened to the South of England when he had suppressed the rebellion of Tostig in the North.
George IV. was appointed Regent when his father was incapacitated by illness.

Compound.—James II. left the country in 1688, and the crown was conferred on William III. and Mary II.
The Wars of the Roses lasted thirty years, and it is said that during that period nearly a million lives were sacrificed.

11. Give short explanations suitable for children of the words italicised in the following passages:—

'No thought was there of distant flight;
Linked in the *serried phalanx* tight;
Groom fought like noble, *squire* like *knight*.'

'As day *declines*, *nature* recovers from this *languor* and exhaustion; the *insects* again *flutter* across the open glades, and the larger animals *saunter* away from under cover in the direction of the ponds and *pastures*.'

(*a*) *Linked*, joined together; *serried*, closely arranged; *phalanx*, company, body; *groom*, an attendant, chiefly employed to take care of horses; *squire*, the attendant or servant of a knight; *knight*, a titled soldier.

'The company was so closely arranged that masters and servants, nobles and common people fought side by side.'

(*b*) *Declines*, comes near its close; *nature*, in this instance used for animated life; *insects*, very small animals that creep or fly, as a bee, or fly; *flutter*, fly; *saunter*, to move quietly; *pastures*, feeding grounds.

'During the heat of the day the animals had gone under cover, and the insects had ceased to fly about in the sun, but as the heat grew less, towards the close of the day, the larger animals came slowly out of their shelter towards the feeding grounds, and the insects again began to fly about in the open spaces.'

12. Give examples of Kindergarten exercises that may be used to stimulate invention and imitation in young children.

Every gift in Kindergarten may be used to stimulate imitation. The teacher can use the gifts in different ways, *e.g.*, rolling the ball, placing the cube and the cylinder in different positions, making the common geometrical figures, doors, windows, rooms, houses, towers, columns, pillars, with the bricks of different sizes; with the box containing pieces of cardboard, triangles, prisms, articles of everyday use; with sticks, letters of different kinds, angles, triangles, gables, trees; with the plait-paper making different patterns, and the children can imitate readily.

With the third gift invention may begin to be stimulated. An infinite variety of figures will suggest themselves to the child's mind when a few have been imitated, and the same with the remaining gifts. A box of one kind has been made, the child invents another, longer, shorter, deeper, or all these together: a column has been shown, two, three, or more suggest themselves: one room has been made, the child goes to two or four; with sticks and peas when once the method has been shown of forming letters or words, then other words, other letters, and other figures suggest themselves, and invention is stimulated by every new figure shown.

13. Point out some of the uses of object lessons in infant schools, and illustrate your answer by short notes of a lesson on 'The Whale,' *or* on 'Iron.'

The uses of object lessons in infant schools are to awaken the intelligence, to train the eye, the ear, the touch, and mental powers, thus cultivating the perceptive and conceptive faculties. The imparting of information is a secondary use, the information given being a means rather than an end.

WHALE.

Introduction.—Seen fish in a shop (ling) as big as themselves; some much larger—the whale.

Size.—60 to 100 feet long (compare with school).

Thickness.—Show picture with man beside it, and draw a circle on board to show thickness compared with a man.

Parts of body.—*Head*, large and strange shape; *mouth*, wide and long (compare with room or table, or form): *eyes*, small; *nostrils*, on top of head; *tail* (draw shape on black board); *fins*, large.

Habits.—Floats often on water, why? needs to breathe, being warm-blooded; swims slowly, four miles an hour (boys run as fast), lives on small fish, catches them while swimming with open mouth, water runs out through whalebone in mouth.

Where found.—Cold seas (show picture of catching whales, and elicit danger from tail of fish, ice, etc.).

Uses.—Show *whalebone*—hand it to children and ask its colour and qualities—*blubber*, speak of oil in lamps, etc., and show how we depend largely for oil from blubber of whale.

14. Show that by the aid of a blackboard or other apparatus plain darning may be taught simultaneously to a large class.

The easiest way of explaining the method of darning to a large class is either by the use of Kindergarten paper, a ball frame without the balls, the blackboard, or the whole of them combined. The first stitches across a hole to be darned may be shown by lines drawn on the blackboard, or the bars across a ball-frame, or long strips of Kindergarten paper, then the cross stitches may be shown by coloured or white threads woven

in and out of the wires of the ball-frame, or by coloured papers woven in and out of the strips of paper already used. A whole class can see a frame fixed on the blackboard, or, if in a gallery, held in the hand on a table.

Domestic Economy.

Three hours allowed for this Paper.

Candidates are not permitted to answer more than *one* question in each section.

Section I.

Needlework.

1. Describe fully the following stitches, and say in what garments and materials they are commonly used, and how you would teach them to children :—*hemming, felling, backstitching, feather-stitching, i.e., coral-stitching.*

Hemming.—Turn in the edge of the material and double over a second time. Take up two threads of the main part of the material on the needle, and two of the turned-in hem, the needle being held diagonally, draw the thread through, and take up the bottom as before, leaving two threads of the material between each stitch.

Bottoms of calico and holland garments, and hemming on bands.

Felling.—When a seam has been made, the stitch used for hemming down the raw edges is called *felling*. Stitch as in hemming.

Used for all seams in all garments except flannel.

Backstitching.—Draw a thread to mark the direction the stitch is to take. Take up two threads of the cloth, then put in the needle in the same place as at first, taking up two threads behind and two before the working cotton.

Bands for neck or wrist, shirt fronts, and gussets.

Feather-stitching.—Fasten in the thread, stitch it diagonally on the material, holding it with the thumb, fasten down by a back stitch; stretch the thread in the opposite direction, and fasten as before, and so on alternately. Two or more stitches may be taken at the end of the diagonal thread.

Used for flannels instead of stitching, and in all places where stitching is used on other materials.

2. Describe the process of cutting out, and making a pinafore of six-years old, with exact measurements, and an account of the materials required.

An ordinary-sized child of six would require a pinafore of 22 to 24 inches in length.

Take one breadth of material (36 in.) 24 inches long, fold in four selvedge-wise, laying it on the table with the middle of the material uppermost on the right, mark off 2½ inches along the top and down the side of the left top corner, join by straight line, cut through four thicknesses along the straight line. Down the same side mark to 9 inches, and cut through slightly curved line for arm-holes. From top 2½ draw curved line to point two inches below right top corner, open, and lay on table with middle of pinafore to the right. Mark off from left hand corner 1½ inches down left side, and draw curved line; now cut the slopes along the curved lines, back and front.

Seam and fell shoulders, hem round armholes, bottom, and neck, the latter broad enough to take a tape; gather the front or leave plain as desired; if plain, sew on strings 9 inches from neck; if gathered, stitch on band at front long enough to tie behind.

Section II.

Savings and Investments.

1. State the annual income on which, in your opinion, a retired schoolmistress could live in comfort in her old age; and the methods of saving and investment in her days of full work and salary, by which she could provide that income on retirement.

The income required would depend greatly upon the place in which the retirement took place. In towns, where rents of rooms are high, more would be needed than in the country, where rooms are cheaper, and where living generally is cheaper than in town. An economical mistress being her own dressmaker would be able to enjoy a comfortable life on from £30 to £50 a year.

This sum can be obtained by mistresses at the present time in various ways—the chief by life insurance (the sum being paid after a certain number of years, or at death, if that previously occur), by the purchase of a deferred annuity; by savings placed in savings banks, or by judicious investments in safe concerns yielding a little more interest than the Post Office Savings Bank.

A mistress saving £12 10s. per year could purchase with it an annuity of £50 a year, payable after reaching the age of 50, supposing she commenced at the age of 21, and continued her payments to that time.

2. On what weekly wages can an artisan maintain in comfort himself, his wife and four children between the ages of four and ten; and in what proportion should he distribute those wages in rent, food, clothing, education of his children, recreation and savings?

A town artisan can earn and live comfortably under the conditions prescribed in the question on 35s. a-week.

He would need for rent 5s. 6d.; food, 19s. 6d.; clothing 5s. education of his children 1s.; recreation 1s.; and savings 3s.

Section III.

Food—its Ingredients.

1. What effect is produced on the human body by food containing large quantities of the following substances respectively—(*a*) sugar, (*b*) lime, (*c*) salt, (*d*) animal oils?

(*a*) Large quantities of sugar serve to increase the heat of the body; they also tend to increase the weight of the body; being stored up in the body in the shape of fat, the bulk of the body is increased.

(*b*) Lime is necessary for the purpose of giving hardness to the bones. Too much of it, however, affects the digestive organs.

(*c*) Salt in large quantities produces scurvy.

(*d*) Animal oils increase the weight of the body, produce great heat, disarrange the digestive organs, and are often the cause of indigestion and biliousness.

2. State fully what are the objections to a diet either exclusively vegetable or exclusively animal.

The substances required as food by the body are carbon, hydrogen, oxygen, nitrogen, water and salts of alkalies, earths and metals. No substance can serve as food permanently, which does not contain nitrogen. The composition of most articles of food is such that it contains one or more of these substances in excess, and any of them alone would not supply those elements necessary for forming flesh, or giving heat to the body. In order, therefore, that the organs of the body may not be overtaxed in obtaining the materials for either of these purposes, a mixed diet is necessary. For example, if a person is fed on fatless meat, in order to obtain sufficient carbon he would require to eat five to six pounds, while one pound would supply him with sufficient nitrogen, and his digestive organs would require to do four times the amount of needful work. He would be able to get the necessary carbon and nitrogen from 2 lbs. of bread, and ¾ lb. of meat. If he attempted to get the necessary amount of nitrogen from a potato diet he would need 10 or 12 lbs. daily, while 3 lbs. would be sufficient with ¾ lb. of meat. On the other hand, if a person tried to live only on flesh-forming food, he might die in consequence of the loss of vital power in getting the necessary amount of carbon.

Section IV.

Food—its Preparation.

1. Describe the efficient modes of cooking potatoes; give your opinion as to the merits of each, and say for what dish of meat each mode of cooking them is most suitable.

Potatoes may be boiled, steamed, roasted or baked, and fried. Potatoes may be boiled in two ways, with or without the jackets; the former is the more economical and better, as the most nutritious part of the potato is said to lie close to the skin.

Method: clean and brush well, put in saucepan with cold water, boil slowly, add a little salt occasionally. Probe, and when tender, pour off the water and dry thoroughly.

Boiled:—Peel carefully, place in cold water, boil steadily, when soft pour off water, place by fire, shake occasionally, and cover with napkin, instead of pan-lid for a short time.

Roasted or baked:—Wash well and clean with brush; place in oven and bake till enough, serve on a hot napkin.

Steamed:—Pare neatly, wash in cold water, put them in steamer which fits above pan of boiling water. When pierced easily by a fork they are done, shake steamer for a minute and serve hot.

Fried:—Slice after paring, and fry in dripping. When brown and crisp drain on a towel and serve in a deep dish. Boiled or steamed to any kind of meat; roasted to roast meat or fish; fried potatoes to steaks; boiled and mashed potatoes to hashes, minced collops, or stews.

2. Give an account of the materials, preparation, and cooking of an economical and wholesome dinner for a schoolmistress living alone,

Either stewed steak and potatoes, and suet pudding; or minced collops and boiled rice would make a readily-prepared, economical, and wholesome dinner.

Take ½ or ¾ lb. of steak, and put in pan with cold water and a few drops of vinegar; cut up a carrot or a leek or an onion; place pan where it will simmer all morning during school hours. In another pan place a small suet pudding prepared as follows: two ounces of suet chopped fine, mixed with ½ lb. of flour, a little baking powder and salt, into a paste with milk or water, tie in well-floured cloth; place where it will boil all morning. Immediately on coming home place potatoes pared before school in steam pan above pudding, put steak on fire and let it boil, adding pepper and salt.

Serve pudding with jam, sugar, butter or treacle, according to taste. Finish with a little cheese if desired. Total cost, 10d. to 1s.

SECTION V.

Rules for Health.

1. Mention any respects in which the modern fashion of female dress is injurious to health, and show in what way each foolish practice in dressing produces its bad effects.

The great prevalent evils of female dress at present in vogue are those of tight-lacing and the wearing of high-heeled small boots. The former practice hinders the work of the respiratory and digestive organs, gives a malformation to the ribs, and is the source of diseases of the lungs, indigestion, and biliousness.

High-heeled boots throw the body forward, and put the greatest weight on the toes, which are forced into a narrow compass at the pointed toe of the boot. Corns, partial lameness, inability to take much walking exercise, and an ungainly gait are the consequences. The thin soles worn are also the cause of coughs and colds, and diseases which follow.

2. Give plain rules for the preservation of health for a pupil teacher (*a*) who lives in the country a mile from her school, and (*b*) for a pupil teacher in London living a few doors from her school.

To both.—Attend regularly to personal cleanliness and to cleanliness of clothing. Secure regularly at least eight hours' sleep, and keep regular hours.

(*a*) Start at least 20 minutes before the time you are expected at school, so as not to overheat yourself with walking; wear strong boots to protect the feet, and be prepared for changes of weather by carrying with you an umbrella, and a thin waterproof, which will serve either as a wrapper from cold, or a preventative of getting wet.

(*b*) Take half an hour's walking exercise before going to school in the morning. If the weather is too wet for it, use the dumbbells and backboard for half that time. Take a similar walk after an interval of rest in the afternoon.

3. What would you do before the doctor came if a child in your school (*a*) was badly scalded, (*b*) had fainted, (*c*) had cut his arm above the elbow.

(*a*) Avoid exposure to the air. Cover the injured part with flour, and this with a sheet of cotton wadding, or soft linen rag; keep the child quiet and warm.

Or cover with soft linen rag after pouring on oil, or spirits of turpentine if the skin is not broken.

(*b*) Take into open air, lay the child on his back, unfasten all garments about wrists and neck, keep the head a little raised, let him smell smelling-salts, rub the hands gently to help circulation, give a little warm coffee if it can be swallowed, and bathe the temples, forehead, and hands with water.

(*c*) Press the thumb tightly above the wound, while another ties a handkerchief tightly round the arm, and twists it still tighter by means of a cane or stick pushed underneath the handkerchief. The flow of blood will thus be checked and the child saved from bleeding to death.

SECTION VI.

Clothing and Washing.

1. Describe the modes of washing, drying, and getting up the different articles which would go into the tub on washing day in a labourer's cottage.

Sort first, dividing into three heaps, white articles, flannels, towels and aprons. Soak in soft water in which soap has been boiled, rubbing with soap the dirty places. Place in washing-machine (if any—or poss-tub), and wring out of the dirty water. Rub the dirty parts again with soap, and one part against another or brush with a hard brush, place in pot and boil with soap and soda; wring out of a clean water in machine or by hand and hang out to dry.

Flannels are rubbed through the second water of the white clothes, passed quickly through a clean water, and hung out at once to dry to prevent shrinking.

Next come the dirty towels, working aprons, and other coarse articles, which after rubbing will need a good boiling with soap and soda. The man's clothes being heavy and very dirty will come last, and will be treated in the same way as the towels. When nearly dry pass several times through mangle (if any), and iron with a hot iron. Linen cuffs and collars to be ironed wet, out of cold water starch.

2. Give an account of the price, material, colour, and making up of a neat dress for your own summer wear in school, and say how it should be washed and worn so as to last as long as possible.

Suitable washing materials for dresses for summer wear are prints, hollands, pompadours, and galateas. The prices of these range from 6½d. to 1s. 3d. per yard. They may be had in any colour and pattern, the most suitable perhaps being blue and white, or brown and white. Ten to twelve yards will be required, and a neat, elegant style of making-up known as a princess' robe, of walking length, is a very suitable one for school wear. Whichever material is chosen, the dress should be washed carefully in moderately warm water, without soda or washing powder, and dried in the shade, after being wrung out in a little starched water. It should be mangled first, and well ironed. To last as long as possible, care should be taken not to get it wet, inked, or torn on forms or desks at school. It should be worn during school hours only.

ANSWERS TO

Pupil Teachers' Examination Papers.

SEPTEMBER 30TH, 1882.

CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find by practice what £17 18s. 1d. per day will amount to in a solar year of 365 days 5 hrs. 48 min.

	£	s.	d.
1 day =	17	18	1
			365
365 days =	6535	0	5
4 hours = ⅙ of 1 day =	2	19	8½
1 ,, = ¼ of 4 hrs. =	0	14	11 1/12
30 min. = ½ of 1 ,, =	0	7	5 5/24
15 ,, = ½ of 30 min. =	0	3	8 1/24
3 ,, = ⅕ of 15 ,, =	0	0	8 4/5
	£6539	6	11 4/5 Ans.

2. If the rent of a farm of 55 acres be £151 6s. 8d., what should be the rent of another farm containing 36 acres 3 roods if 11 acres of the former be worth 8 acres of the latter?

$$\left.\begin{matrix}55 \text{ ac.} \\ 8\end{matrix}\right\} : \left.\begin{matrix}36\tfrac{3}{4} \text{ ac.} \\ 11\end{matrix}\right\} :: £151\tfrac{3}{4} : \text{rent}$$

$$\frac{£454 \times 36\tfrac{3}{4} \times 11}{3 \times 55 \times 8} = \frac{£424 \times 147 \times 11}{3 \times 320 \times 8} = \frac{£227 \times 49}{80} = £139 \text{ os. } 9\text{d.}$$

3. Calculate, by practice, the difference between 540½ tons at £20 16s. 8d. per ton, and three thousand and sixty-seven pounds at seven shillings and sevenpence three-farthings per pound.

	£	s.	d.
(*a*) Value of 540½ at £1 =	540	5	0
			20
,, ,, £20 =	10805	0	0
,, ,, 10s. = ½ at £1 =	270	2	6
,, ,, 6s. 8d. = ⅓ ,, =	180	1	8
	£11255	4	2

	£	s.	d.
(*b*) Value of 3067 at £1 =	3067	0	0
,, ,, 5s. = ¼ at £1 =	766	15	0
,, ,, 2s. 6d. = ⅛ at 5s. =	383	7	6
,, ,, 1½d. = 1/160 at 2s. 6d. =	19	3	4½
,, ,, ¼d. = ½ at 1½d. =	3	3	10½
	£1172	9	9½

∴ The difference = £11255 4s. 2d. − £1172 9s. 9½d. = £10082 14s. 4½d. Ans.

4. How many yards of cloth at 6s. 7½d. a yard will cost the same sum as 371 yards at 6s. 9d. a yard?

6s. 7½d. : 6s. 9d. :: 371 yds. : ?
or or
159 halfd. 162

$$\frac{371 \text{ yds.} \times 162}{159} = 378 \text{ yds. Ans.}$$

FEMALES.

1. Make out the following bill:—

189 yards of cloth at 15s. 6d. per yd.
40½ yards of diaper at 1s. 7d. per yd.
64 yards of muslin at 12s. 6d. per yd.
72 yards of cambric at 5s. 6d. per yd.
14 hats at 12s. 6d. each.
19 umbrellas at 18s. 7½d. each.

	£	s.	d.
189 yds. at 15s. 6d. =	146	9	6
40½ ,, 1s. 7d. =	3	4	1½
64 ,, 12s. 6d. =	40	0	0
72 ,, 5s. 6d. =	19	16	0
14 hats at 12s. 6d. each =	8	15	0
19 umbrellas at 18s. 7½d. each =	17	13	10½
	£235	18	6. Ans.

2. Find the cost of 14,865 articles at 13s. 6½d. each.

	£	s.	d.
Cost of 14,865 arts. at £1 each =	14865	0	0
,, ,, ,, 6s. 8d. = ⅓ at £1 =	4955	0	0
,, ,, ,, 6s. 8d. = ⅓ ,, £1 =	4955	0	0
,, ,, ,, 2½d. = 1/12 at 6s. 8d. =	154	16	10½
	£10,064	16	10½

3. What would be the cost of 16 yds. 2 ft. 10 in. of cloth at 2s. 6½d. per yard?

	£	s.	d.
Cost of 1 yd. =	0	2	6½
			16
,, 16 yds. =	2	0	8
,, 1½ ft. = ½ of 1 yd. =	0	1	3½
,, 1 ft. = ⅔ ,, =	0	0	10⅓
,, 4 in. = ⅓ of 1 ft. =	0	0	3 7/11
	£2	3	0 3/11. Ans.

4. Find the value of 70,014⅜ at £1 13s. 8d. each.

	£	s.	d.
Value of 70,014⅜ at £1 each =	70014	7	6
,, ,, 6s. 8d. = ⅓ at £1 =	23338	2	6
,, ,, 6s. 8d. = ⅓ at £1 =	23338	2	6
,, ,, 4d. = 1/60 at 6s. 8d. =	1166	18	1½
	£117,857	10	7½

Grammar.

1. Point out and parse all the verbs and adjectives in the following:—

'O Brignall banks are wild and fair,
And Greta woods are green,
And you may gather garlands there
Would grace a summer queen.'

Brignall—dist. adj., limiting 'banks.'
are—irreg. intrans. verb, *am, was, been*, indic., pres. indef., 3rd pers. plur., agr. with 'banks.'
wild—predic. adj., qual. 'banks.'
fair— ,, ,, ,, ,,
Greta—dist. adj., limiting 'woods.'
are—same as before, agr. with 'woods.'
green—pred. adj., qual. 'woods.'
may gather—reg. trans. verb, potential, pres. indef., 2nd pers. plur., agr. with 'you.'
would grace—reg. trans. verb, potential, past indef., 3rd pers. plur., agr. with (*which*).
summer—dist. adj., qual. 'queen.'

2. Give four examples to show how the verb agrees with the nominative in person and number. N.B.—Do not simply give the examples, but explain also how they illustrate the rule.

The verb agrees with its subject in number and person; that is, a verb must take the *form* or *termination* denoting the same number and person with its subject. For example: we say, 'I *am*,' but 'thou *art*,' 'he *is*,' and 'we *are*.' The subjects 'I,' 'thou,' 'he,' and 'we' cannot be substituted for one another before these words without injuring the concord.

3. Give some rules for forming the plurals of nouns, with examples.

(1) The plural is commonly formed by adding *s* to the singular, as book, books.
(2) Nouns ending in *s, sh, ch* (soft), *z, x*, or *o* (preceded by a consonant), take *es*, as Miss, Misses; brush, brushes; match, matches; topaz, topazes; fox, foxes; hero, heroes.
(3) Nouns ending in *y* after a consonant or *u* change *y* into *ies* in the plural, as lady, ladies; soliloquy, soliloquies.
(4) Nouns ending in *f* or *fe* change *f* or *fe* into *ves*, as loaf, loaves; life, lives; (staff takes staves.)
(5) Man, with its compounds, takes *men*; foot, feet; goose, geese; die, dice (for gaming); child, children; ox, oxen; mouse, mice; tooth, teeth; brother, brothers, or brethren.

Geography.

Answer Nos. 1 and 2; and then No. 3 if you have time.

1. What is meant by an *Indented coast?* Give examples in Great Britain and Ireland.

An indented coast is one which is broken up by arms or inlets of the sea. For example, the West and North of Scotland is so much indented by long inlets or lochs, as they are called, that no place is more than forty miles from the sea. The North and West coasts of Ireland are almost as much broken as the same coasts in Scotland. The West and South coasts of England are also more indented than the East coast.

2. What is meant by *watershed* or *water-parting?* Give examples in Great Britain, and show, by the courses of rivers, that there is a real *parting* of the waters.

Watershed and *waterparting* are two words belonging to the supply of water to rivers. A waterparting is the spot or line at which the surface-water of a mountain, hill, or swelling ground parts, and begins to flow down the slope on each side. Some mountains have a ridge almost as sharp as that of a roof, others are more irregular. Some undulating ground is pretty flat on the whole, and it is difficult to say by the eye where the waterparting is; but water will always find its own level, and there is always a line at which the water will, of itself, flow down the one side or the other, and the line, straight or crooked, is the waterparting. The waterparting being the ridge or highest line between the streams, the watershed is the whole ground between the waterparting and the stream.

The Pennine chain extends from the western extremities of the Cheviots to the Peak of Derby, and forms the great water-parting of the North of England. It sends off to the North Sea, the Tyne, Wear, Tees, Yorkshire Ouse, and the left affluents of the Trent; and to the Irish Sea, the Eden, Lune, Ribble and Mersey.

The Cheviot and Lowther Range extends from the borders of England to Loch Ryan in Wigtownshire, and forms the great water-parting of the South of Scotland, separating the basins of the Tweed and Clyde from those of the Solway and Tyne.

3. Name in order the counties of Wales, with the chief towns of each.

If you can, draw a plain map (without marking mountains or rivers) to illustrate your answer.

Flint—Mold. Holywell, Flint. *Denbigh*—Denbigh, Wrexham. *Caernarvon*—Caernarvon, Bangor. *Anglesea*—Holyhead, Amlwch. *Merioneth*—Bala, Dolgelly. *Montgomery*—Montgomery, Welchpool. *Cardigan*—Cardigan, Aberystwith. *Pembroke*—Pembroke, Haverfordwest. *Caermarthen*—Caermarthen, Llanelly. *Glamorgan*—Cardiff, Swansea, Merthyr Tydvil. *Brecknock*—Brecon. *Radnor*—New Radnor.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Dislodging*.

Write, in small hand, as a specimen of copy-setting, *Bolingbroke was destined to be the sport of Fortune.*

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the value of $(\frac{3}{5}-\frac{2}{7}+\frac{1}{8}-\frac{1}{6}+\frac{1}{4})\div(\frac{3}{5}-\frac{1}{4}+\frac{2}{3}-\frac{1}{2})$.

$$\frac{560-720+315-420+504}{2520}\div\frac{280-105+252-60}{440}=$$

$$\frac{179-1140}{2520}\div\frac{532-165}{420}=$$

$$\frac{239\times420}{2520\times367}=\frac{239}{2202}\text{ Ans.}$$

2. Reduce 17 cwt. 3 qrs. 7 lbs. to the decimal of three-quarters of a ton, and multiply the result by 21·3.

(*a*) $\frac{17\text{ cwt. }3\text{ qrs. }7\text{ lbs.}}{\frac{3}{4}\text{ ton}}=\frac{1995\text{ lbs.}}{1680\text{ lbs.}}=\frac{19}{16}=1\cdot1875$

(*b*) $1\cdot1875\times21\cdot3=1\cdot1875\times\frac{64}{3}=\frac{76}{3}=25\cdot3$ Ans.

3. The price of gold being £3 17s. 10½d. per oz., find the price of ·0013 of an oz.

$$£3\ 17s.\ 10\tfrac{1}{2}d.\times\cdot0013=934\tfrac{1}{2}d.\times\cdot0013$$

$$=\frac{1869d.\times13}{20000}$$

$$=\frac{24297}{2}$$

$$=1\frac{4297}{2000}d.\text{ Ans.}$$

4. A train going at the rate of 16⅔ miles an hour, travels a certain distance in $4\frac{7}{12}$ hours, how long would a train going at the rate of 20⅝ miles an hour be in travelling the same distance?

20⅝ mls. : 16⅔ mls. :: $4\frac{7}{12}$ ho. : time.

$$\frac{55\text{ho.}\times84\times8}{12\times5\times165}=\frac{44}{15}\text{ho.}=3\text{ho. }44\text{min. Ans.}$$

FEMALES.

1. A field of 12 acres having 120 stalks to each square yard, and 70 grains to each stalk, produces wheat to the value of £96 16s.; what will be the worth of the produce of 800 square yards, having 175 stalks to the square yard, and 45 grains to each stalk?

58,080 yards : 800 yards
120 stalks : 175 stalks
70 grains : 45 grains
:: £96 16s. : ?

$$\frac{1936s.\times800\times175\times45}{58,080\times120\times70}=25s.=£1\ 5s.\text{ Ans.}$$

2. If I pay 1s. 3d. for 6 lbs. 14 oz. of bread when wheat is 4s. 9d. per bushel, what must I pay for 23 lbs. 12 oz. when wheat is 5s. 5d. per bushel?

6 lbs. 14 oz. : 23 lbs. 12 ozs.
or or
110 oz. : 380 ozs.
57d. : 65d.
:: 15d. : ?

$$\frac{15d.\times380\times65}{110\times57}=\frac{741}{11}d.=4s.\ 11\tfrac{10}{11}d.\text{ Ans.}$$

3. I spend twelve guineas in thirty-five days, and save £100 a year, what must I earn in a year?

35 days : 365 days :: £12 12s. : expenditure

$$\frac{252s.\times365}{35}=2628s.=£131\ 8s.$$

∴ he must earn £131 8s. + £100 or £231 8s. Ans.

4. An income of £3827 12s. 6d. is taxed at the rate of 7d. in the pound; how much clear income will remain?

233d. is clear income out of every 240d.

∴ 240d. : 233d. :: £3827⅝ : clear income

$$£\frac{30,621\times233}{240\times8}=£\frac{7,134,693}{1920}=£3715\ 19s.\ 8\tfrac{3}{4}d.\text{ Ans.}$$

Grammar.

1. 'The reverend pile lay wild and waste,
Profaned, dishonoured, and defaced.
Through storied lattices no more
In softened light the sunbeams pour;
For dark Fanaticism rent
Altar, and screen, and ornament.'—SCOTT.

(*a*) Point out and parse all the adverbs and prepositions in the above.

(*b*) How do you know that the word 'for' in the above is not a preposition?

(*a*) *no more*—adv. phrase modif. *pour*.
wild and *waste*—adj. used adverbially.
profaned, *dishonoured*, and *effaced*—parts. used adverbially.
through—prep. relating 'pour' and 'lattices.'
in—prep. relating 'pour' and 'light.'

(*b*) 'For' is not a preposition, because it does not show any relation between a noun, a verb, or an adjective, and a substantive or substantive phrase or sentence. It introduces a subordinate adverbial sentence of cause, and is therefore a subordinating conjunction.

2. The prepositions *after*, *on*, *within*, and *without* are sometimes used as adverbs. Give examples, four, in which they are used as prepositions, and four in which they are used as adverbs.

Prepositions.

(*a*) You shall ride *after* us.
(*b*) The examination takes place *on* Saturday.
(*c*) The reckoning was *within* the mark.
(*d*) Students do not succeed *without* perseverance.

Adverbs.

(*a*) We shall go first and you can come *after*.
(*b*) Ride *on*! ride *on* in majesty.
(*c*) They were heard singing *within*.
(*d*) Around the flaming pile we sat,
While the wolves howled loud *without*.

3. Decline the pronouns He and Who.

Sing.	Plur.	Sing.	Plur.
Nom. He	They	Nom. Who	Who
Poss. His	Theirs (their)	Poss. Whose	Whose
Obj. Him	Them	Obj. Whom	Whom
(Dat. Him)	(Dat. them)		

Geography.

Answer either Q. 2 or Q. 3, not both.

1. Draw a map of the coast-line from Dantzic to Bordeaux, marking river-mouths, capes, bays, and islands near the coast. Insert the lines of latitude and longitude.

2. Name the chief towns of Germany, describing the situation and general character of each.

Berlin is situated on the Spree, an affluent of the Havel. It is the capital of the German Empire, an elegant city famous for the variety and extent of its manufactures. It is the great centre of intellectual development in the North of Germany.

Breslau is the second city in Germany in point of population. It is situated on the Oder, has a large trade, extensive manufactures, and is the seat of a university.

Cologne is the third city in Prussia, and the most important in the western division of the kingdom. Its position on the Rhine gives it great commercial facilities. Noted for its Cathedral and distilled waters.

Königsberg, a strongly fortified city on the Pregel, near its mouth in the Frische Haff, is noted for its manufactures, ship-building, and trade in grain.

Dantzig, a fortified city near the mouth of the Vistula, is one of the greatest corn-shipping ports in the world.

Magdeburg, the strongest fortress in the kingdom, has great trade, which is facilitated by numerous steamers on the Elbe.

Frankfürt, formerly a free city, is a populous commercial place on the Main, now noted for its banking transactions.

Hanover is a well-built trading and manufacturing city on the Leine.

Stettin, a fortified city at the mouth of the Oder, and next to Dantzig, the chief sea-port of the kingdom.

Coblentz, at the confluence of the Rhine and Moselle, the former of which is crossed here by a bridge of boats. On the opposite bank of the Rhine is the formidable fortress of Ehrenbreitstein.

Hamburg, on the estuary of the Elbe, is the most important commercial city on the Continent.

Bremen, a free city on the Weser, second to Hamburg as a seat of German commerce, is the great port for emigration to America.

Dresden on the Elbe, over which there is a magnificent bridge a quarter of a mile long. It is a fine city with manufactures of China and porcelain.

Munich (München), in the midst of a sterile plain, is by far the most populous city in South Germany. Its painting and sculpture are unrivalled in Germany.

3. Trace minutely (in words) the courses of the Rhone and the Po.

The *Rhone*, a large and rapid river of France, rises in Switzerland, five miles from the source of the Rhine, and expands into the Lake of Geneva, issuing from which it forms the boundary between Haute-Savoie and Ain, and Ain and Isère. From Lyons its course is southerly, and after passing Vienne, and Valence, and Avignon, it enters the Mediterranean by four mouths.

The *Po*, the largest river in Italy, issues from Monte Viso, and traversing the plains of Piedmont and Lombardy from west to east, discharges itself after a course of about 350 miles into the Adriatic by several mouths.

History.

1. What sovereigns reigned between 1066 and 1189? Give dates as well as names.

		A.D.
Harold II.	began to reign	1066
William I.	,,	1066
William II. (Rufus)	,,	1087
Henry I.	,,	1100
Stephen	,,	1135
Henry II.	,,	1154-1189.

2. How long did William and Mary fill the throne? Tell when each of them died.

			A.D.		
William III.	reigned from		1689	till	1702
Mary II.	,,	,,	1689	,,	1694.

3. Make a list of our sovereigns from 1702 to the present time, with dates.

		A.D.
Anne	began to reign	1702
George I.	,,	1714
George II.	,,	1727
George III.	,,	1760
George IV.	,,	1820
William IV.	,,	1830
Victoria	,,	1837.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Disobliging*.

Write, in small hand, as a specimen of copy-setting, *Bolingbroke was destined to be the sport of Fortune.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. Find the simple interest on £215 12s. 6d. for 3 years 73 days at 4½ per cent. per annum.

$$£215\tfrac{5}{8} \times 3\tfrac{1}{2} \times \frac{4\frac{1}{2}}{100} = \frac{£1725}{8} \times \frac{16 \times 9}{5 \times 200}$$
$$= £\frac{345 \times 9}{100}$$
$$= £31\ 1s. \quad \text{Ans.}$$

2. In a school there are 371 boys, 233 girls, and 256 infants. What per centage of the whole school is there in each department? (Correct to two places of decimals.)

Total in school = 371 + 233 + 256 = 860

$$860 : \left\{\begin{matrix}371\\233\\256\end{matrix}\right\} :: 100 \left\{\begin{matrix}43{\cdot}139 & \text{per centage of boys.}\\27{\cdot}09 & ,, \quad \text{girls.}\\29{\cdot}76 & ,, \quad \text{infants.}\end{matrix}\right.$$

3. Find the value of £⅛ per cent. on £150 10s. − 6s. 3d. per cent. on £200 10s. + £3½ per cent. on £5060 10s.?

	£
$\frac{850{\cdot}5 \times \frac{1}{8}}{100} = \frac{8{\cdot}505}{8}$	= 1·063125
deduct $\frac{00{\cdot}5 \times \frac{5}{12}}{100} = \frac{10{\cdot}025}{16}$	= ·6265625
	= ·4365625
Add $£\frac{5060{\cdot}5 \times 7}{200} = \frac{354{\cdot}234}{2}$	= 177·1175
	177·5540025
	= £177 11s. $0\frac{22}{25}$d. Ans.

4. If a man pays the same amount of income-tax when it is raised from 6d. to 9d. per £1, by how much per cent. has his income diminished?

9d. : 6d. :: £100 : per centage on which tax is paid

$$£\frac{100 \times 6}{9} = 66\tfrac{2}{3}$$

∴ the income has diminished $33\frac{1}{3}$ p. c.

FEMALES.

1. Find what quantity multiplied by ⅔ of ¼ of 3½ gives a result equal to ⅞.

$$\text{The No.} = \tfrac{7}{8} \div (\tfrac{2}{3} \text{ of } \tfrac{1}{4} \text{ of } \tfrac{7}{2})$$
$$= \frac{7 \times 3 \times 5 \times 0}{9 \times 2 \times 4 \times 7} = \frac{5}{12} \text{ Ans.}$$

2. Required the value of $1\frac{1}{3}+\frac{3}{5}$ of $\frac{4}{11}+\frac{4}{51\frac{1}{6}}$.

$$\text{Value}=\tfrac{4}{3}+\tfrac{12}{51}\tfrac{4}{1}+\tfrac{4}{51}\tfrac{0}{1}$$
$$=\frac{68+164+40}{51}=\tfrac{27}{51}\tfrac{2}{1}=\underline{5\tfrac{1}{3}}. \text{ Ans.}$$

3. A person possessed of $\frac{7}{8}$ of a coal mine sells $\frac{2}{3}$ths of his share for £2,000, what is the whole mine worth?

$\frac{2}{3}$ of $\frac{7}{8}$: 1 :: £2000 : worth of mine.

$$\pounds\frac{2000\times5\times4}{3\times2}=\underline{\pounds6,666\ 13s.\ 4d.}\ \text{Ans.}$$

4. A can do a piece of work in 5 days, B in 6, and C in 7; how much of it can they do jointly in 2 days?

A does $\frac{2}{5}$ in 2 days, or $\frac{42}{105}$
B ,, $\frac{1}{6}$,, ,, $\frac{35}{105}$
C ,, $\frac{2}{7}$,, ,, $\frac{30}{105}$

∴ A, B, and C can do $\frac{107}{105}$ or they are able to do the whole and $\frac{2}{105}$ more in the two days.

Grammar.

1. 'Not his the nerves that could sustain
Unshaken, danger, toil, and pain;
Yet this meek lover of the lyre
Nursed one true spark of noble fire;
Against injustice, fraud, or wrong,
His blood beat high, his hand was strong.'—SCOTT.

(*a*) Supply the verb in the principal sentence, and show why it is a principal sentence.

(*b*) Point out the subordinate sentence in the above, and state to which class of subordinate sentences it belongs.

(*c*) Point out all the words in the above that are in the objective case and explain their government.

1. (*a*) and (*b*) 'Not his (were) the nerves' is the principal sentence, because it contains the main idea; '*that could sustain* pain' is a subordinate *adjective* sentence, and qualifies the noun 'nerves.'

(*c*) *Danger, toil,* and *pain*, are abstract nouns in the objective, governed by the transitive verb 'could sustain.'

lyre—objective, governed by the prep. 'of.'
spark— ,, ,, ,, trans. verb, 'nursed.'
fire— ,, ,, ,, prep. 'of.'
injustice, fraud, and *wrong*—obj., governed by 'against.'

2. Give four examples, two of conjunctions joining co-ordinate (principal) sentences; two of conjunctions joining subordinate to principal sentences.

(1) Co-ordinate sentences.
(*a*) He confessed his fault, *and* was forgiven.
(*b*) I would assist you; *but*, alas! I have not the means.

(2) Subordinate sentences.
(*a*) He will be forgiven *if* he confess his fault.
(*b*) I cannot assist you, *because* I have not the means.

Geography.

Answer either Q. 2 or Q. 3; not both.

1. Draw a map of the coast-line from Dantzic to Bordeaux, marking river-mouths, capes, bays, and islands near the coast. Insert the lines of latitude and longitude.

2. Give notes of a lesson on this subject:—'*Our Colonial Possessions and their Value;*' showing which of them are useful to us for purposes of trade, which for emigration, and which for defence against foreign enemies.

NOTE.—*Lesson to be given before a map of the world.*

DEFINITION OF COLONY.—Colony is a foreign possession peopled by emigrants from a parent state. A British colony is peopled by settlers from Britain, which is called the mother country. Explain difference between 'emigrant' and 'colonist,' difference between a colony and a dependency. Australia is, properly speaking, a colony; India, a dependency.

POSITION OF THE COLONIES.—British colonies are not confined to any quarter of the world, but are scattered over all parts of its surface. In Europe are Heligoland, Gibraltar (the key of the Mediterranean), Malta, in the Mediterranean. In Asia are India, Ceylon, Hong Kong, Straits Settlements, Aden and Perim. In Africa are Cape Colony and others in the south, and Sierra Leone and others on the West Coast. St. Helena, Ascension, and Mauritius, off the coast. In America are Canada, British Columbia, and the most of the Leeward and Windward islands of the West Indies, with Jamaica, Bahamas, Trinidad, British Guiana, Honduras, and the Falkland Islands. Australia and New Zealand.

CHARACTER AND VALUE OF THE COLONIES.—Colonies indirectly confer great advantages on the mother country. One of the most valuable is that they furnish a new home for thousands of poor, who find it a hard struggle to live in their own country. Canada, Cape Colony, Australia, and New Zealand are especially adapted for this. Others are valuable as stations for sheltering our fleets, and consequently protect our commerce; such are Heligoland, Gibraltar, Malta, Mauritius. Others are trading stations, in which raw produce from the surrounding countries may be collected, or from which English goods may be distributed to them. Singapore and the settlements in West Africa are of this character. Others are useful as stations or half-way houses at which ships may call to take in water or provisions or coal; for example, Gibraltar, St. Helena, Mauritius, Aden, and the Falkland Islands.

3. Trace minutely (in words) the course of the St. Lawrence.

The St. Lawrence has its most remote sources in the western tributaries of Lake Superior and its entire length is estimated at 2150 miles. A large portion of its immense basin is occupied by magnificent freshwater lakes, the largest in the world. The river receives different names in the different parts of its course, as the St. Louis above L. Superior; the St. Mary between L. Superior and L. Huron; the St. Clair, between Lakes Huron and St. Clair; the Detroit, between Lakes St. Clair and Erie; the Niagara (famed for the Falls), between Lakes Erie and Ontario; the Iroquois, between Lake Erie and Montreal; and the St. Lawrence between that city and the Gulf of St. Lawrence.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Trace the descent of Richard I. from William I., and as far as you can show the names and nationalities of Royal Consorts in the line.

William I. (the Conqueror) m. Matilda, of Flanders.
|
Henry I. (consort, Matilda of Scotland).
|
Matilda m. Geoffrey of Anjou.
|
Henry II. (Eleanor Countess of Anjou).
|
Richard I. (Berengaria of Navarre).

2. When and by whom was the first House of Commons called? Do you think that event of importance to the people?

In 1265, during the reign of Henry III., the first parliament was summoned by De Montfort, Earl of Leicester. This parliament is most memorable as including members who formed the original of the House of Commons. The knights of the shires and the representatives from cities and towns being elected by the people without doubt must be regarded as the beginning of the present Lower House, which is really the leading power in the state. The event is most important to the people because in voting money for the use of the Crown, the representatives of the people claim the right of calling on the sovereign to redress grievances.

3. What possessions had Henry VI. in France? How did he lose them?

Shortly after the death of Henry V., Charles VI. of France died, and his son, Charles VII., was crowned king of France at Poitiers, ruling south of the Loire, while *Henry VI.* was proclaimed King of France at Paris, his dominions being north of the Loire. The assumption of authority by Charles VII. was, of course, a direct violation of the treaty of Troyes. The English cause was ably maintained by Bedford, the ablest man of that age. The French were defeated by the Earl of Salisbury at Crevant, and by Bedford at Verneuil. In 1428 the English crossed the Loire and laid siege to Orleans. This famous siege lasted for seven months, and proved to be a great turning-point

in English and French history. The appearance of Joan of Arc soon caused the raising of the siege, and step by step did the heroic maid lead the French from victory to victory, until the coronation of Charles at Rheims. The events belong more especially to a history of Joan. The young king Henry was brought over to Rouen, 1430, and about a year and a half after was crowned at Paris. In 1435 the Duke of Burgundy concluded a peace with Charles and a few days after the great Duke of Bedford died. This event was the finishing blow to the dominion of England in France. By the marriage of Henry and Margaret of Anjou, the estates of Maine and Anjou were returned to her father. War continued until 1453 when not a foot of ground remained to England of all her continental possessions except Calais.

Composition.

Write full notes of a lesson on *Slate*.

Notes of a lesson on *Slate*.

I. WHAT IT IS.—When clay has been in a dry state for a very long time and has been pressed very much by other rocks, it can no longer be softened by water, and it can, when taken fresh from the quarry be split in thin flakes, or sheets by a chisel. It is called slate. Some time after being taken from the quarry, especially if the slate is acted on by frosts and thaws, it can no longer be split. Its colour is blue, grey, or greenish. (*Show pieces of roofing and other slates.*)

II. WHERE FOUND.—Slate is abundant in the mountains of North Wales, West of Argyle, Yorkshire, Westmoreland, Cornwall, Devonshire, in Spain and Italy, where pencil is made from it. The largest slate quarries of Wales are at Penrhyn and Llanberis, whence large quantities are exported to America and Australia. (*Places to be shown on map.*)

III. USES.—Slate is used for covering roofs, for cisterns, for mantle-pieces, headstones, whetstones, pencils. (*Show how adapted for these uses.*)

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Disobliging*.

Write, in small hand, as a specimen of copy-setting, *Bolingbroke was destined to be the sport of Fortune.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. From a given point P, to draw a straight line equal to a given straight line QR.

Prop. 2, Bk. I.

2. If the side MN of a triangle LMN be produced to R, the angle LNR shall be greater than the angle MLN.

Prop. 16, Bk. I.

3. If from the ends of a side of the triangle FGH there be drawn two straight lines to the point K within the triangle, these shall be less than the other two sides of the triangle, but shall contain a greater angle.

Prop. 21, Bk. I.

Needlework.

FEMALES.

One hour allowed for this Exercise.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the principal of which the simple interest for $3\frac{1}{2}$ yrs. at $2\frac{1}{2}$ per cent. will be £551 18s. $6\frac{1}{4}$d.

£2 10s. : £551 18s. $6\frac{1}{4}$d.
or 2400 far. $3\frac{1}{2}$ yrs. : or 529,851 far. 1 yr. } :: £100 : principal.

$$\frac{£100 \times 529{,}851 \times 2}{2400 \times 7} = £\frac{105970200}{16800} = £6307\ 15s.$$ Ans.

2. A person loses at the rate of 10 per cent. by selling cloth at 15s. a yard. How ought it to have been sold to gain 20 per cent?

90 : 120 :: 15s. : required selling price.

$$\frac{15s. \times 120}{90} = 20s.$$ Ans.

3. What will be the simple interest of 649 francs 75 centimes for 5 yrs. 4 months, at 3 centimes interest per annum for each franc lent? (100 centimes = 1 franc.)

$$\text{Interest} = 649{\cdot}75 \text{ frs.} \times 5\tfrac{1}{3} \times {\cdot}03 = \frac{649{\cdot}75 \text{ frs.} \times 16 \times 3}{3 \times 100}$$
$$= 103{\cdot}96 \text{ frs.} = 103 \text{ frs. } 96 \text{ cents.}$$ Ans.

4. The population of a country is at present thirty-two millions; if it increases at the rate of 5 per cent. every year, what will it be at the end of 5 years?

This is equivalent to finding compound interest.

5 p.c. = $\frac{1}{20}$ of whole

32,000,000		
1,600,000		
33,600,000	population at end of	1st yr.
1,680,000		
35,280,000	,, ,,	2nd ,,
1,764,000		
37,044,000	,, ,,	3rd ,,
1,852,200		
38,896,200	,, ,,	4th ,,
1,944,810		
40,841,010	,, ,,	5th ,, Ans.

FEMALES.

1. Find the simplest vulgar fractions equivalent to the decimals ·432, ·00625, ·1015625, ·0109375.

$$·432 = \frac{432}{1000} = \tfrac{54}{125}$$
$$·00625 = \frac{625}{100{,}000} = \tfrac{1}{160}$$
$$·1015625 = \frac{1015625}{10{,}000{,}000} = \tfrac{13}{128}$$
$$·0109375 = \frac{109375}{10{,}000{,}000} = \tfrac{7}{640}$$

2. Simplify 1·26 of $66\frac{2}{3} + 5\frac{1}{2}$ of 1·0375; and $3\frac{5}{8}$ of ·003 − ·0011 of $7\frac{1}{2}$.

(*a*) 1·26 of $66\frac{2}{3} = 1{\cdot}26 \times \frac{200}{3} = 84$

$+ 5\frac{1}{2}$ of $1{\cdot}0375 = \frac{26 \times 1{\cdot}0375}{5} = 5{\cdot}395$

$89{\cdot}395$ Ans.

(*b*) $3\frac{5}{8}$ of ·003 $= \frac{29 \times {\cdot}003}{8} = {\cdot}010875$

$- {\cdot}0011$ of $7\frac{1}{2} = \frac{{\cdot}0011 \times 29}{4} = {\cdot}007975$

$·0029$ Ans.

3. What is the value of ·07 of £2 10s. and of ·0474609375 of £10 13s. 4d.?

(*a*) ·07 of £2 10s. = 50s. × ·07 = 3·5s. = 3s. 6d. Ans.

(*b*) £10 13s. 4d. = 2560d. × ·0474609375 = 121·5d.
= 10s. $1\frac{1}{2}$d. Ans.

4. The price of ·0625lbs. of coffee being ·4583s., what is the cost of ·075 of a ton?

·0625 lbs = $\frac{1}{16}$ lb.
·075 ton. × 2240 = 168 lbs.
·4583 = $5\frac{1}{2}$d.
$\frac{1}{16}$: 168 :: $5\frac{1}{2}$d. : ?

$5\frac{1}{2}$d. × 168 × 16 = 14784d. = £61 12s. Ans.

Grammar.

1. 'There spent with toil he listless eyed
The course of Greta's playful tide;
Beneath her banks now eddying dun,
Now brightly gleaming to the sun.
Then tired to watch the current's play
He turned his weary eyes away,
To where the bank opposing showed
Its huge square cliffs through shaggy wood.'
—SCOTT.

(*a*.) Point out the enlargements of the subject which occur in the above.

(*b*.) Analyse the last three lines.

(*c*.) Point out and parse all the participles in the above.

(*a*) The enlargements of the subject are, (1) 'spent with toil,' (2) 'tired to watch the current's play.'

Analysis of (*a*)

(*b*)

Subject	... ...	'he'
Predicate	... ...	'turned'
Object	... ...	'eyes'
Enlargement of object		'his, weary,'
Extensions	... ...	(1) away,
		(2) 'to where,' . . . through shaggy wood,' *adv. clause of 'place.'*

Analysis of (*b*)

Subject	'the bank'
Enlargement of subject ...	'opposing'
Predicate	'showed'
Object	'cliffs'
Enlargements of object ...	'its,' 'huge,' 'square.'
Extension of predicate ...	'through shaggy wood' (manner.)

(*c*) *Spent*—irreg. intrans. verb, *spend, spent, spent*, complete part. qual. 'he'
eddying—reg. intrans. verb, incomplete part. qual. 'tide'
gleaming—reg. intrans. verb, incomplete part. qual. 'tide'
tired—reg. intrans. verb, incomplete part. qual. 'he'
opposing—reg. intrans. verb, incomplete part. qual. 'bank.'

2. Give examples of words compounded with the Latin prepositions *de*, *sub*, *trans*, and show what is the force of the preposition in each word.

de (down, away, from): *de*cay, *de*clare, *de*duct, *de*ject, *de*legate, *de*ny, *de*scend, *de*odorize.

sub (under, from, below, inferiority): *sub*altern, *suc*ceed, *suf*fix, *sug*gest, *sum*mon, *sup*plant, *sur*rogate, *sus*ceptible, *sou*venir, *so*journ. (The last two are French.)

trans (across, over, through, beyond): *trans*act, *tran*quil, *trans*cend, *tra*dition, *tres*pass, *tra*verse.

Geography.

1. Draw a full map of Turkey in Asia, including Palestine. Insert the lines of latitude and longitude.

2. Give notes of a lesson on 'Our Possessions in Africa;' *not* describing any one of them minutely, but giving the children clear ideas of their position, general character, and history.

OUR POSSESSIONS IN AFRICA.

METHOD.—Lesson to be given before a Map of Africa, or of the Eastern Hemisphere, or what is a better plan, outline map on black-board for places to be sketched as the lesson proceeds. Route from England, and distance to be shown clearly, by sketch and comparison. Children may have relations in some parts of Africa; elicit as much information as possible from the children, to get their own ideas of the Colonies.

POSSESSIONS.	POSITION.	GENERAL CHARACTER.	HISTORY.
I.—Cape Colony.	In south-western end of the Continent. Orange R. northern boundary, Indian Ocean on E., Atlantic on W., Antarctic on S.	Surface rises in three terraces from the coast to the interior. Flat district on coast. Little Karroo. Great Karroo. Climate warm and healthy. Deficient in rain. Flowers very brilliant.	The Cape discovered by Diaz, 1487. Colonized by Dutch, 1652. Taken by British, 1795. Restored to Dutch by Treaty of Amiens. Retaken 1806.
II.—Natal.	S.E. shores of Africa, between Drakenberg Mts. and the sea. 800 miles from the Cape.	Rises in three terraces, as in the Cape. Climate, resembles our own. Soil, various. Vegetables of all kinds abundant. Diamonds.	Discovered on Christmas Day, and called Natal, 1497. 1824 first British Settlement. Proclaimed a British Colony 1843.
III.—Griqua Land.	Between Cape Colony and the Transvaal.	Prevailing character is that of undulating plains, suitable for grazing. Diamond diggings.	Proclaimed British territory 1871. Diamond digging chief dependence of the inhabitants.
IV.—West African Settlements:—			
(*a*) Sierra Leone.	(*a*) In the basin of the Rokelle.	(*a*) Climate unhealthy. Fevers frequent.	(*a*) Colonized 1787.
(*b*) Gambia.	(*b*) At the mouth of the Gambia.	(*b*) Unhealthy. Exports various.	(*b*) Queen Elizabeth granted a patent to trade in 1591.
(*c*) Cape Coast Castle.	(*c*) Coast of Guinea.	(*c*) Unhealthy. Palm oil exported. Ground-nuts from Gambia.	(*c*) Portuguese settled this coast. English took it, 1661.
(*d*) Lagos.	(*d*) Near the Delta of the Niger.	(*d*) Some as (*c*.)	(*d*) Joined with Lagos 1824.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What is meant by the Union of the Roses? How was this event brought about?

The Red and White Roses were the emblems adopted by the respective partisans of the houses of York and Lancaster, and worn by them in the long and sanguinary wars which desolated England during the reigns of Henry VI. and Edward IV., and were only terminated by the victory of the Lancastrian Henry Tudor, Earl of Richmond, at Bosworth Field, over Richard III. in 1485. The victor represented both houses, having married Elizabeth of York, daughter of Edward IV., and thus was brought about the Union of the Roses.

Who was Sir Thomas More? Give some account of his end.

Sir Thomas More succeeded Wolsey as Chancellor under Henry VIII., 1529. He continued to hold office till 1532, when, rather than favour the king's designs to procure a divorce from Catherine, and a marriage with Anne Boleyn, he retired from his Chancellorship. From this time Henry appears to have resolved upon the destruction of his old favourite. By a law, passed in the Session of 1533-34, it was made high treason to do anything to the prejudice of the king's lawful matrimony with Queen Anne; and it was provided that all persons should take an oath to maintain the whole contents of the statute. At the end of the Session Commissioners were appointed to administer the oath, and More was summoned before them to take it. More declined, was committed to the Tower, tried for high treason, and beheaded in 1535.

3. Mention some of our famous naval heroes, and give dates and particulars of Nelson's chief victories?

Among the naval heroes may be mentioned Drake, Blake, Monk, Dean, Penn, Jordan, Russell, Rodney, Howe, Jervis, Duncan, and Nelson.

In 1798, at the Battle of the Nile, the English (with fourteen ships) under Nelson, defeated the French (seventeen ships), under Admiral Brueys. Nine of the enemy's ships were captured.

In 1801 Lord Nelson bombarded Copenhagen. The whole Danish fleet was captured or destroyed, and the town compelled to surrender.

In 1805, off Trafalgar, the British fleet of twenty-seven sail and four frigates under Lord Nelson, engaged the French and Spanish under Admirals Villeneuve and Gravina (thirty-three sail and five frigates.) Nineteen of the enemy's ships were captured, but Nelson was killed in the hour of victory.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Disobliging*.

Write, in small hand, as a specimen of copy-setting, *Bolingbroke was destined to be the sport of Fortune.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including No. 2 (if possible).

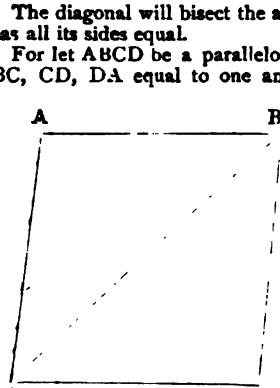
1. If a straight line QT, falling on two other straight lines PR, SV, make the alternate angles equal to one another, these two straight lines shall be parallel.

Prop. 29. Bk. I.

2. In what case will the diagonal bisect the angle of a parallelogram?

The diagonal will bisect the angle of a parallelogram when it has all its sides equal.

For let ABCD be a parallelogram having its four sides AB, BC, CD, DA equal to one another, and join DB; then DB shall bisect the angles ADC, ABC.



Because AB=AD, the angle ABD=the angle ADB (I. 5).

For the same reason the angle CDB=angle CBD.

But the angle ABD=the angle BDC. (I. 28.)

∴ the angle ABD=the angle CBD, that is, DB bisects ABC.

In the same way it may be shown that DB also bisects ADC.

Wherefore the diagonal bisects the angle of a parallelogram when all its sides are equal.—Q.E.D.

3. Let the sq. described on MN, one of the sides of △ MNR, = the sqs. on the other two sides of MR, RN.

Then shall ∠ MRN be a rt. ∠.

Prop. 48. Bk. I.

Algebra.

MALES.

Answer two Questions, including No. 2 (if possible).

1. Find the value of $\frac{x^4-y^4}{(x^2+y^2)^2}-\frac{x(x^2+xy+y^2)}{x^3-y^3}$ when $x=4$, $y=-3$.

$$\frac{256-81}{(16+9)^2}-\frac{4(16+4\times(-3)+9)}{64+27}=\frac{175}{625}-\frac{4\times13}{91}=$$
$$\frac{7}{25}-\frac{4}{7}=\frac{49}{175}-\frac{100}{175}=-\frac{51}{175}. \text{ Ans.}$$

2. Prove the rule for finding the greatest common measure of two expressions.

Find it for $6a^3-6a^2y+2ay^2-2y^3$ and $12a^2-15ay+3y^2$; and hence reduce $\frac{12a^2-15ay+3y^2}{6a^3-6a^2y+2ay^2-2y^3}$ to lowest terms.

The proof of the rule for finding the G. C. M. depends on the following principles:

(*a*) If D divide A, then it will divide mA. For since D divides A, we may suppose A=aD, then mA = maD; thus D divides mA.

(*b*) If D divide A and B it will divide mA±nB. For since D divides A and B, we may suppose A=aD, and B = bD, then mA±nB=(mA±nB) D; thus D divides mA±nB.

Let A and B denote the two algebraical expressions, and let them be arranged according to descending powers of some common letter, and suppose the index of the highest power of that letter in A not less than the index of the same letter in B. Divide A by B: let p denote the quotient, and C the remainder. Divide B by C; let q denote the quotient and D the remainder. Divide C by D, and suppose that there is no remainder, and let r denote the quotient. Thus we have the following results:—

B) A (p
pB
C) B (q
qC
D) C (r
rD

A = pB+C; B = qC+D; C = rD.

Now, D divides C since C = rD; hence by principle (*a*) D also divides qC, and also qC+D; that is, D divides B. Again, since D divides B and C, it divides pB+C; that is, D divides A. Hence, since D divides A and B, it is a common measure of them. D is not only a common measure, but *the* greatest common measure.

By principle (*b*) given above, every expression which divides A and B divides A−pB, that is, C; thus every expression which is a measure of A and B is a measure of B and C. Similarly every expression which is a measure of B and C is a measure of C and D. Thus every expression which is a measure of A and B divides D. But no expression higher than D can divide D. Thus D is the G. C. M.

$$\begin{array}{r|l} 12a^2-15ay+3y^2 & 6a^3-6a^2y+2ay^2-2y^3 \\ & \quad 2 \\ & \overline{12a^3-12a^2y+4ay^2-4y^3}\,(a+y \\ & \underline{12a^3-15a^2y+3ay^2} \\ & \quad 3a^2y+ay^2-4y^3 \\ & \quad\quad 4 \\ & \overline{12a^2y+4ay^2-16y^3} \\ & \underline{12a^2y-15ay^2+3y^3} \\ & \quad 19y^3 \end{array} \qquad \begin{array}{r|l} 19ay^2-19y^3 & \\ & a-y \\ \overline{12a^2-15ay+3y^2} & (12a-3y \\ \underline{12a^2-12ay} & \\ -3ay+3y^2 & \\ -3ay+3y^2 & \end{array}$$

∴ the G. C. M. is $a-y$. Ans.

And ∴ $\frac{12a^2-15ay+3y^2}{6a^3-6a^2y+2ay^2-2y^3}$ will be in its lowest terms if each term is divided by $a-y$, that is $\frac{12a-3y}{6a^2+2y^2}=\frac{3(4a-y)}{2(3a^2+y^2)}$.

3. Solve the equations:—

$$(1)\ \frac{3x+1}{2}-\frac{2x}{3}=10+\frac{x-1}{6}$$
$$(2)\ \frac{1}{x-1}-\frac{2}{x+7}=\frac{1}{7(x-1)}$$

(1) Clearing of fractions, $9x+3-4x=60+x-1$

$$9x-4x-x=60-1-3$$
$$4x=56$$
$$x=14. \text{ Ans.}$$

(2) Clearing of fractions, $7x+49-14x+14=x+7$

$$7x-14x-x=7-49-14$$
$$8x=56$$
$$x=7 \text{ Ans.}$$

Needlework.

FEMALES.

One hour allowed for this Exercise.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. If a tax of 12 per cent. on the income of a country yields £5,200,000, how much will an income-tax of 5d. in the £ produce?

$$\frac{12}{100} : \frac{5}{240} :: £5{,}200{,}000 : ?$$

$$\frac{£5{,}200{,}000 \times 5 \times 100}{12 \times 240} = \underline{£902{,}777\ 15s.\ 6\tfrac{2}{3}d.}\ \text{Ans.}$$

2. A person's salary is £450 a year. He has £750 10s. stock in the 3 per cents., £500 railway debentures bearing 4½ per cent. interest, and £385 15s. India 5 per cent. stock. What does he pay a year for income tax at 5d. in the £?

		£
(*a*) £750·5 × $\frac{3}{100}$	=	22·515
(*b*) 500 × $\frac{4\frac{1}{2}}{100}$	=	22·5
(*c*) £385·75 × $\frac{5}{100}$	=	19·2875
Salary	=	450·
Total income	=	514·3025

(*d*) ∴ tax = 5d. × 514·3025 = 2571·5125d. = £10 14s. $3\frac{11}{80}$d.

3. A person buys coffee at £5 12s. 6d. per cwt. and chicory at £2 5s. 5d., and mixes them in the proportion of 2 of chicory to 5 of coffee. If he retails the mixture at 1s. 2½d. a pound, what is his gain per cent.?

	£	s.	d.
5 cwt. at £5 12s. 6d. =	28	2	6
2 ,, £2 5s. 5d. =	4	10	10
7 cwt. cost	32	13	4
∴ 1 ,, ,,	4	13	4
and 1 ,, is sold for 1s. 2½d. × 112 =	6	15	4
gain on 1 cwt. =	2	2	0

£4⅘ : £2$\frac{1}{10}$ :: 100 : gain p.c.

$$\frac{100 \times 21 \times 3}{10 \times 14} = \underline{45.}\ \text{Ans.}$$

4. Ten thousand pounds stock in the 3 per cents. is sold out at 92⅜, paying the usual brokerage; the whole is then reinvested in railway 6 per cent. £20 shares when they are at £5 premium clear. Find the alteration in income.

(*a*) Income from first investment = £10,000 × $\frac{3}{100}$ = £300

(*b*) By selling £10,000 it becomes £10,000 × $\frac{92{\cdot}25}{100}$ = £9225

(*c*) Income from railway shares = £9225 × $\frac{6}{125}$ = £442 16s.

∴ difference of income is £442 16s. − £300 or **£142 16s.** Ans.

FEMALES.

1. Required the amount of £825 13s. 8d. at 4¾ per cent. simple interest, in 3 years and 5 months.

$$\text{Interest} = £825\ 13s.\ 8d. \times \frac{4\frac{3}{4}}{100} \times 3\tfrac{5}{12}$$

$$= \frac{£134\ 0s.\ 0\tfrac{17}{20}d.}{100}$$

	£	s.	d.
=	134	0	$0\frac{340}{1200}$
Add	825	13	8
∴ Amount =	£959	13	$8\frac{340}{1200}$. Ans.

2. If two men A and B together can perform a piece of work in 10 days, and A by himself can do it in 18 days, what time will it take B to do it?

A and B can do $\frac{1}{10}$ in 1 day or $\frac{9}{90}$

A alone ,, $\frac{1}{18}$,, ,, $\frac{5}{90}$

∴ B alone ,, ,, ,, $\frac{4}{90}$

If B does $\frac{4}{90}$ in 1 day, then he will do the whole in $\frac{90}{4}$ days or $22\frac{1}{2}$ days. Ans.

3. A person paid a tax of 10 per cent. upon his income; what must his income have been when, after he had paid the tax, there was £1,250 remaining?

After paying 10 per cent. he has $\frac{9}{10}$ remaining;

therefore his whole income = $\frac{£1{,}250 \times 10}{9}$ = £1388 17s. 9½d.

4. If 126 yards of cloth be bartered for 3 hhd. of brandy at 6s. 8d. per gallon, what is the price of the cloth per yd.?

126 yds. : 3 hhd. or 189 gals. :: 6s. 8d. : price of a yard.

$$\frac{6s.\ 8d. \times 189}{126} = 3s.\ 4d. \times 3 = \underline{10s.}\ \text{Ans.}$$

Grammar.

1. 'Every eye can *see* the beauty of the *remote;* but there is a beauty in the *near which* every eye cannot see. *Each* of the thousand little plants *that* spring *up* at *our* feet has an interest and beauty for the botanist; the mineralogist would *find* something to *engage* him in every little stone.'—WILSON.

(*a*) What kind of sentences are connected by adversative conjunctions? by relative pronouns? Illustrate your answer from the above, and give other examples.

(*b*) Parse the words in italics.

(*a*) (1) Co-ordinate principal sentences are connected by adversative conjunctions; as, 'Every eye can see the beauty of the remote,' *but* 'there is a beauty in the near which every eye cannot see.' 'I would assist you,' *but* 'I have not the means.' 'He tried frequently,' *but* 'he never succeeded.'

(2) Relative pronouns connect subordinate adjective sentences with the principal, qualifying some noun like a simple adjective; thus, 'which every eye cannot see' qualifies 'beauty'; 'that spring up at our feet' qualifies 'plants'; 'The man *who perseveres* generally succeeds,' 'who perseveres' qualifies 'man.'

(*b*) *See*—irreg. trans. verb, *see, saw, seen,* infin. pres., gov. by 'can.'

remote—adj. used as a noun, collective, neuter, plur., obj., gov. by 'of.'

near—same as 'remote,' collective, neuter, plur., obj., gov. by 'in.'

which—simple rel. pron., referring to 'beauty,' 3rd pers., sing. neut., obj., gov. by 'see.'

each—distrib. adj. pronoun, referring to ('*plant,*') 3rd pers. sing., neut., nom. to 'has.'

that—simple rel. pron., referring to 'plants,' 3rd pers., plur., neut. nom., subject of 'spring.'

up—adv. of manner modifying 'spring.' *Note.*—'Up' rather forms a part of the compound verb 'Up-spring.'

our—pronom. poss. adj., limiting 'feet.'

find—irreg. trans. verb, *find, found, found,* infin. pres., indef., gov. by 'would.'

engage—reg. trans. verb, infin., pres. indef., gov. by 'something,' or rather attributive to 'something.'

2. How comes it that there is a Latin, Celtic, and a Teutonic element in our language? Give examples of words belonging to each.

The language spoken by the Ancient Britons was Celtic, and many geographical and a few household names belong to this language, which is now represented by the Welsh and Gaelic; as, *Avon, Pen-macnmawr, Arran, Penrith, Auchinleck; mop, basket, bran.*

The Teutonic language comprises the Scandinavian dialect, and as men of Scandinavian race (Picts, Norsemen, and Danes) made repeated incursions into this island from the close of the eighth to the close of the tenth centuries, many words of Teutonic origin found their way into common use. The Scandinavian element in modern English includes geographical names; as, *Holbeck, Grimsby, Orkney, Dungeness, Skipton;* names of persons; as, *Anderson*; and words in common use; as, *braze, dairy, earl.*

The Romans occupied Britain for about four hundred years. The Latin introduced by the Romans themselves has been called *Latin of the First Period;* as, *Lancaster, Chester, Lincoln, Portsmouth, Wallbury.* The Latin brought in through intercourse with the Church of Rome is called *Latin of the Second Period;* as, *cloister, candle, saint.* The Latin that came to us through the Normans in the corrupt form of Norman French is called *Latin of the Third Period;* as, *armour, falcon, charity, baron.*

The Latin that has been introduced by scholars since the revival of learning during the latter part of the fifteenth century is called *Latin of the Fourth Period.*

Geography.

1. Give notes of a lesson on 'The Eastern Coastline of the Atlantic Ocean.' Draw a map in illustration, and insert the lines of latitude and longitude.

'The Eastern Coastline of the Atlantic Ocean.'

METHOD.—Sketch on blackboard the various items as the lesson proceeds.

I. SHAPE AND EXTENT.—Eastern side nearly parallel with the western project ons on one side, standing opposite indentations on the other—about 1,000 miles long—eastern coastline identical with the west coasts of Europe and Africa.

II. ISLANDS ALONG EAST COASTLINE.—East side of North Atlantic:—Great Britain and Ireland, Faroe Is., Channel Is., Canary, Madeira, and Cape Verd Is. Azores, and the islands in the Gulf of Guinea. The East side of South Atlantic has none of any importance.

III. BRANCHES ON THE EAST.—Baltic, North Sea, Irish Sea, English Channel, Bay of Biscay, Mediterranean, Gulf of Guinea.

IV. RIVER SYSTEMS.—East coast and its branches receive the principal rivers of the Old World:—Rhine, Loire, Tagus, Rhone, Po, Danube, and Don; Nile, Senegal, Niger, Congo, Orange.

2. Trace minutely (in words) the course of the Mississipi; describing the physical features of the country watered by it and its tributaries, and the chief towns in its basin.

The *Mississippi* rises in L. Itasca at an elevation of 3,000 feet. It receives the St. Peter's River, and continues south, receiving in succession the *Wisconsin*, *Iowa*, *Des Moines*, and *Illinois*, before it is joined by the *Missouri*, which, rising about the same parallel as the Mississipi, unites with its tributary the *Yellowstone*. The united stream flows S.E., through a fine open prairie, receiving the *Platte*, the *Kansas*, and the *Osage*. At the junction of the Missouri and Mississipi the streams are about half-a-mile wide, and, with the same width, the combined stream rushes on till joined by the *Ohio*, which rises in the Apalachian Mts., flows through a fertile and beautiful country, and has for branches the *Wabash*, *Cumberland*, and *Tennessee*. The main river, joined on the right bank by the *Arkansas*, flowing through a sandy district, flows on south to be augmented by the waters of the *Red River*, after which it enters the Gulf of Mexico. The area of its basin is estimated at a million and a quarter square miles. The principal towns are *Iowa*, *Jefferson*, *St. Louis*, *Pittsburg*, *Cincinnati*, *Natchez*, and *New Orleans*.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Mention the European territories which have, at any time, belonged to England, and tell how we lost them?

By the Treaty of Troyes, concluded after the victories of Henry V., it was agreed that Henry should be Regent of France, and on the death of King Charles VI. succeed to the throne of that country. The Dauphin Charles refused to abide by the treaty, and Henry returned to fight him and his followers. During the campaign he died (1422), leaving Bedford, one of the cleverest men of his time, to maintain the cause of the young Henry VI. On the death of Charles VI. the Dauphin was crowned king, reigning over the country south of the Loire, while the part north of the Loire was held for Henry. Bedford in the first years of the war gained several victories, especially at Verneuil (1424.) But the victory was soon to be with the French.

Joan of Arc appeared on the scene, to inspire the French, and to lead them to victory. She succoured Orleans, then besieged by the English, and compelled the besiegers to retire (1429.) The 'Maid of Orleans,' as she was called, also defeated Talbot, one of the best of the English commanders; and Charles VII. was actually crowned at Rheims. In spite of the baseness of the English in burning Joan as a witch, their cause grew weaker and weaker, especially after the death of Bedford (1435); and at the end of the Hundred Years' War, England possessed not a spot of French territory except Calais, which was lost in the reign of Mary I. 1558.

2. What do you understand by the Declaration of Rights? Under what circumstances was it drawn up and signed?

In the Convention Parliament of 1689, the Prince of Orange refused the proposal of a regency; and, before filling the vacant throne, the Commons drew up, and the Lords accepted the 'Declaration of Rights,' which might be called the '*Magna Charta of the Revolution*,' only that its origin was above that of any royal charter, in the will of the people. It recapitulated the offences of the late king; reasserted the ancient rights of the people; settled the crown first on William and Mary, as king and queen; next on the survivor of them; then on the queen's issue; failing them, on the Princess Anne, and her issue; and lastly, failing them, on the issue of the Prince of Orange.

3. When was the Quebec Act passed? Explain its main provisions, and show their effect upon Canada during the war of American Independence.

The Quebec Act was passed 1774. By this Act, the Roman Catholic religion was set free from legal disability, and reinstated in its right to exact tithes and other dues from all persons who owned its sway; French civil law was reimposed, but the Criminal Code of England was set up instead of that of France; and the province was to be ruled by a Government and Council appointed by the Crown, one-third of the Council being composed of French Canadians.

It inflicted many evils on the Colony, but it served well the immediate purpose for which it was intended. It satisfied the old settlers, and held them firmly to the side of England during the wars which England vainly waged against the American Colonies.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word, *Disobliging.*

Write, in small hand, as a specimen of copy-setting, *Bolingbroke was destined to be the sport of Fortune.*

Composition.

Write a short essay on *Courts of Justice.*

Courts of Justice are of various kinds, according to the various constitutional systems of different countries. Some may have limited jurisdiction, both as to place and as to the kind of matters which they can hear and determine. Some have no limit to their jurisdiction, except the limits that the government itself has—namely, its territory. From those Courts that have a limited jurisdiction, there may be an appeal to those Courts which have not a limited jurisdiction; and accordingly, some Courts may be called inferior, and others superior, or other terms may be used to express this relation.

In England and Ireland the superior courts of common law are the Queen's Bench, Exchequer, and Common Pleas. The law which is called equity, is administered in the Court of Chancery.

From each of the three superior courts of common law in England and Ireland, there is an appeal to the Court of Exchequer Chamber; and a further appeal to the House of Lords, which is the Supreme Court of Appeal.

In Ireland the Court of Quarter Sessions is similar to the English County Court, the Chairman of which is a barrister-at-law, who has exclusive jurisdiction in civil cases, and presides with the Justices of the Peace in criminal cases.

In Scotland the Supreme Civil Court is the Court of Session. It consists of an Inner and an Outer House, and has thirteen judges attached to it. An appeal in matters of law is given to the House of Lords. The High Court of Justiciary is the highest Criminal Court. There is a Sheriff Court in every county.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including Q. 2 if possible.

1. Let APZ be a right-angled $\triangle$, having the rt. $\angle$ APZ Then the sq. on AZ = the sqs. on AP, PZ.

Prop. 47, Bk I.

2. If the sides of a triangle be as 2, 4, 5, is it acute or obtuse angled? (Prop. 12, Bk. II.)

If the sides of a triangle be as 2, 4, 5, it is an obtuse-angled triangle, for the square described on the side which is 5 is greater than the sum of the squares on the other two sides; that is 25 is greater than 4+16 or 20. For the angle opposite the greater side cannot be a right angle, since the squares on 5 would then be equal to the sum of the squares on the other side, by I. 47; and the angle cannot be acute, since the square described on the first side would then be less than the sum of the squares described on the other sides, by II. 13; therefore the angle must be obtuse.

3. To divide a given straight line HK into two parts at L, so that the rectangle contained by HK, LK, may be equal to the square on HL.

Prop. 11, Bk. II.

Algebra.

MALES.

Answer two questions, including Q. 2, if possible.

1. If two fractions are together equal to 1, show that their difference is the same as the difference of their squares.

Let $\frac{x}{y}$ be one fraction, then $1-\frac{x}{y}$ or $\frac{y-x}{y}$ = the other

By hypothesis $\frac{x}{y}\times\frac{y-x}{y}=\left(\frac{x}{y}\right)^2\times\left(\frac{y-x}{y}\right)^2$

First let $\frac{x}{y}$ be the greater, then $\frac{2x-y}{y}=\frac{x^2}{y^2}-\frac{y^2-2xy+x^2}{y^2}$

$$,, \quad =\frac{x^2-y^2+2xy-x^2}{y^2}$$

$$,, \quad =\frac{2xy-y^2}{y^2}$$

$$,, \quad =\frac{2x-y}{y}$$

In a similar manner it may be shown that $\frac{y-2x}{y}$ is equal to the difference of the squares when $\frac{y-x}{y}$ is the greater.

2. Obtain a general rule for the extraction of square root, by observing in what manner a and b may be derived from $a^2+2ab+b^2$.

Extract the square root of $1+x$ to three terms.

Since the square root of $a^2+2ab+b^2$ is $a+b$, a general rule for the extraction of the square root may be obtained by observing in what manner a and b may be derived from $a^2+2ab+b^2$.

$$\begin{array}{l|l} a^2+2ab+b^2 & a+b \\ \hline a^2 & \\ \hline 2a+b)2ab+b^2 & \\ \quad 2ab+b^2 & \\ \hline \end{array}$$

Arrange the terms according to the dimensions of one letter a, then the first term is a^2, and its square root is a, which is the first term of the required root. Subtract its square, that is a^2, from the whole expression, and bring down the remainder $2ab+b^2$. Divide $2ab$ by $2a$ and the quotient is b, which is the other term of the required root. Multiply the sum of twice the first term and the second term, that is $2a+b$ by b, the second term, and subtract the product, that is $2ab+b^2$, from the remainder. This finishes the operation in this instance. If there were more terms we should proceed with $a+b$ as we did formerly with a; its square has already been subtracted from the proposed expression, so we should divide the remainder by the double of $a+b$ for a new term in the root, and then for a new subtrahend we should multiply this term by the sum of twice the former terms and this term. This process must be continued till the root is found.

$$1+x\left(1+\frac{x}{2}-\frac{x}{8}\right) \text{ Ans.}$$

$$\begin{array}{l|l} 1 & \\ \hline 2+\frac{x}{2} & x \\ & x+\frac{x}{4} \\ \hline 2+x-\frac{x}{8} & -\frac{x}{4} \\ & -\frac{x}{4}-\frac{x^2}{8}+\frac{x}{64} \\ \hline \end{array}$$

3. Solve the equations:—

$$\left.\begin{array}{l} (1)\ ax+by=c \\ \quad mx+ny=r \end{array}\right\}$$

$$(2)\ x=5+\frac{6000}{x}$$

(1) $ax+by=c$ or $amx+bmy=mc$ (multiplying by m)
$mx+ny=r$ or $amx+any=ar$ (,, ,, a)

Subtracting $bmy-any=mc-ar$

$$y=\frac{mc-ar}{bm-an} \text{ Ans.}$$

In a similar manner $x=\frac{nc-br}{an-bm}$ Ans.

(2) $x=5+\frac{6000}{x}$

Clearing away fr. $x^2=5x+6000$
Transposing $x^2-5x=6000$
Completing square $x^2-5x+\frac{25}{4}=\frac{24000+25}{4}=\frac{24025}{4}$
Taking root $x-\frac{5}{2}=\pm\frac{155}{2}$
$x=\frac{5}{2}\pm\frac{155}{2}=80$ or -75. Ans.

Mensuration.

MALES.

The sides of a triangle are 11, 24, and 31; show that its area is $66\sqrt{3}$.

$\frac{11+24+31}{2}=33$, half the sum of the sides.

$$\therefore \text{Area}=\sqrt{33\times(33-11)\times(33-24)\times(33-31)}$$
$$=\sqrt{33\times22\times9\times2}$$
$$=\sqrt{13068}$$
$$=\sqrt{4356}\times\sqrt{3}$$
$$=66\sqrt{3}.\text{—Q.E.D.}$$

Needlework.

FEMALES.

One hour allowed for this Exercise.

———o———

Messrs. Isbister and Co. have sent us copies of the first three volumes of their new Natural History Reading Books, by the Rev. J. G. Wood. For reasons which will at once suggest themselves to our readers, we are unable to examine these books critically in the usual column. We must therefore content ourselves by congratulating the Messrs. Isbister upon having secured the services of Mr. Wood, and by saying that, taken altogether, they are the *best* Natural History Reading Books we have seen.

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We have received (just as we go to press) an advance copy of the first number of that periodical whose issue has been looked forward to with so much interest by the literary world—*Longman's Magazine*. We have neither space nor time for detailed criticism, and must therefore content ourselves by saying it appears to us a *marvellous* sixpennyworth. The following authors contribute to it—James Payn, John Tyndall, F.R.S., W. D. Howells, the Author of 'John Halifax, Gentleman,' Richard Owen, R. L. Stevenson, E. A. Freeman, and F. Anstey.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR NOVEMBER, 1882.

STANDARD IV.

A. 1. £431 9s. 3¾d.
2. £20,471 10s. 8d.
3. £651 14s. 3½d.—7.
B. 1. 194,292 lb.
2. £88 18s. 2½d.—75.
3. £185,228 3s. 11½d.
C. 1. 20,880 min.
2. 2s. 4¾d.—4471.
3. 172 ton, 7 cwt., 3 qrs., 3 lb. 5 oz.
D. 1. £29 13s. 9d.
2. 115,706¼ sq. ft.
3. £734 4s. 11½d.
E. 1. £3 5s. 3¾d.—16,935.
2. £182 16s. 3d.
3. 174 c. yd. 26 ft. 1280 in.
F. 1. 25 ton, 0 cwt. 3 qr. 22 lb.
2. 9,652,260 sec.
3. £759 17s. 8½d.

ADVANCED EXAMINATION.

1. 274,239 sq. in.
2. 60s. and 20 h. cr.
3. 1,456,677 min.

STANDARD V.

A. 1. £52 10s. 10½d.
2. £148 5s. 11¼d.
3. 75
B. 1. £4,249 10s. 4¾d.
2. 14s. 7d.
3. £2,892 3s. 4d.
C. 1. 40
2. £7,561 2s. 7½d.
3. £8 10s. 4½d.
D. 1. £26,154 4s. 3d.
2. £16 4s. 5$\frac{5}{12}$d.
3. 119 books.
E. 1. £169,306 8s. 1½d.
2. £8,352 16s. 3¾d.
3. 5 to 3.
F. 1. £29 10s. 4d.
2. £136,849 18s. 8½d.
3. £79 19s. 1$\frac{8}{9}$d.

ADVANCED EXAMINATION.

1. M. £2 10s., w. 16s. 8d., b. 8s. 4d.
2. £33 11s. 8$\frac{4}{9}$d.
3. £486 5s. 7½d.

STANDARD VI.

A. 1. 2$\frac{4}{5}$.
2. $\frac{1}{2}$.
3. $\frac{3}{175}$.
B. 1. ·635.
2. 1900.
3. 10·08 lbs.
C. 1. 66$\frac{2}{3}$ miles.
2. 14 to 13 tr. to p.
3. 3s. 4$\frac{31}{33}$d.
D. 1. ·0006125.
2. $\frac{4}{37}$.
3. £14 17s. 2$\frac{2}{3}$d.
E. 1. 2·6622 ton.
2. 15 ac. 3 r. 25 p. 13$\frac{2}{3}$ sq. yd.
3. ·000852+.
F. 1. $\frac{15\frac{1}{3}}{18\frac{1}{4}}$.
2. ·31522.
3. £366 13s. 4d.

ADVANCED EXAMINATION.

1. 6$\frac{4}{5}$ days.
2. 6$\frac{1}{2}$ days.
3. £1,078 2s. 6d.

STANDARD VII.

A. 1. £17 1s. 3d.
2. £481 9s. 9$\frac{3}{4}$d.
3. £2 14s. 2d. per cent.
B. 1. 2$\frac{11}{13}$ per cent.
2. 4$\frac{12}{13}$ per cent.
3. £357 2s. 10$\frac{4}{7}$d.
C. 1. 2$\frac{11}{13}$ years.
2. 79$\frac{3}{13}$ per cent.
3. 26$\frac{11}{111}$ per cent.
D. 1. £1 2s. ·6$\frac{3}{10}$d.
2. £78 14s. 1$\frac{8}{111}$d. P.W.
3. 1s. 1½d. each knife.
E. 1. £9 17s. 0$\frac{3}{8}$d.
2. £2,125.
3. £20,015.
F. 1. 1$\frac{19}{20}$ average.
2. 2$\frac{44}{81}$ per cent.
3. 2$\frac{7}{10}$d.

ADVANCED EXAMINATION.

1. 6½ per cent.
2. £892 5s.
3. 7s. 4$\frac{3}{4}$1.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR NOVEMBER, 1882.

STANDARD IV.

1. 26 sq. yd. 7 ft. 120 in. = 34,824 sq. in. in small class-room.
34,824 × 1½ = 43,530 ,, large ,,
78,354 × 2½ = 195,885 ,, main room.

274,239 sq. in. Ans.

2. 3s. + 2s. 6d. = 5s. 6d.; £5 10s. ÷ 5s. 6d. = 20 h. cr. Ans.

And 20 × 3 = 60 shillings. Ans.

3. From July 2nd, at 6.48 a.m. =

d.	h.	m.	
182	17	12	rem. of 1879.
366	0	0	year 1880 (leap yr.)
365	0	0	,, 1881.
97	20	45	part of 1882.

Ans. 1,456,677 min. = 1011 13 57

STANDARD V.

1. 48 women = 16 men, and 60 boys = 10 men, making a total equivalent of (40 + 16 + 10 =) 66 men. Then £165 ÷ 66 = £2 10s. a man's share, ½ of £2 10s. = 16s. 8d. a woman's, and ½ of 16s. 8d. = 8s. 4d. a boy's share. Ans.

2.

	s.	d.	£	s.	d.
48 lb. at	0	1¾	an oz. =	5	12	0
1½ cwt. ,,	0	8½	a lb. =	5	19	0
2½ ton ,,	7	6	a cwt. =	16	17	6
480 tins ,,	5	9	a doz. =	11	10	0
80 ,, ,,	0	7½	each =	2	10	0
			Total	42	8	6
			Less 2½d. in the 1s. =	8	16	9½
				£33	11	8¾ Ans.

3. 52 lb. × 532 = 27,664 lb. = 247 cwt.
247 at £1 19s. 4½d. = £486 5s. 7½d. Ans.

STANDARD VI.

1. 1 coat and 1 vest = 1½ coats; 32 hr. ÷ 1½ = 24 hrs. in which A makes a coat. 1 c. + 2 v. = 1⅔ coats; 36 hr. ÷ 1⅔ = 1⅛ = 21⅜ hrs. in which B makes a coat. $\frac{1}{24} + \frac{1}{21\frac{3}{8}} = \frac{1}{11\frac{9}{11}}$ fraction of a coat made by both in one hour. 4 c. + 5 v. = 5⅔ coats; and $(5\frac{2}{3} \div \frac{1}{11\frac{9}{11}} \div 10) = (\frac{17}{3} \times \frac{120}{11} \times \frac{1}{10}) = 6\frac{4}{33}$ days. Ans.

2. Taking the work done by a man in an hour as the *unit*, we have,—10 × 15 × 40 = 6,000 units to be done, and (9 × 12 × 20 =) 2160 + (10½ × 8 × 30 =) 2520 = 4680 units done by first two sets of men. Then 6000 − 4680 = 1320 units yet to be done; 12 × 18 = 216 units done in one day; hence 1320 ÷ 216 = 6⅙ days. Ans.

3. £12,500 × ·425 = £5312 10s. 1st payment.
£12,500 − £5312·5 = £7187·5 the rem. after the above.
£7187·5 × ·85 = £6109 7s. 6d. 2nd payment.
£12,500 − (£5312 10s. + £6109 7s. 6d. =) £1078 2s. 6d. Ans.

STANDARD VII.

1. The working expenses being 60 per cent., the net earnings must be 40 per cent. = (£1,731,250 × 40) ÷ 100 = £692,500. Debenture interest = ⅓ of £2,000,000 = £80,000; preference interest = (£2,500,000 × 4½) ÷ 100 = £112,500. Then £692,500 − (£80,000 + £112,500) = £500,000 dividend on the (£12,500,000 − £4,500,000 =) 8 million ordinary stock. Hence £500,000 ÷ 80,000 (the number of hundreds) = 6¼ per cent. Ans.

2. As the P. W. if invested will yield as much interest as has been deducted for discount, £860 × ⅛ × ¾ = £32 5s. the discount that has been taken off, hence £860 + £32 5s. = £892 5s. Ans.

3. £250 + (20 p.c. of £250 =) £50 = £300 total selling price. £125 + (35 p.c. of £125 =) £43·75 = £168·75 received for half the cloth; £250 ÷ 5 = £50, cost of the fifth; 15 p.c. (£7 10s.) from which = £42 10s. received for the fifth or 160 yds. £300 − (£168·75 + £42 10s.) = £88 15s. selling price of the remaining (800 − 560 =) 240 yards, which gives 7s. 4$\frac{3}{4}$d. a yard. Ans.

THE COBBLER.

Moderato marcato. *mf* T. CRAMPTON.

1st TREBLE.
2nd TREBLE.

1. Tap, tap, tap! goes the cob - bler on his last, Tap, tap, tap! strikes his
2. Tap, tap, tap! with - out ceas - ing, ham - mers he; Tap, tap, tap! till his
3. Tap, tap, tap! thus he earns his dai - ly bread; Tap, tap, tap! thus his

BASS.

KEY C. *Moderato marcato.* *mf*

2nd TREBLE.	d'	.s	:d'	.t	,l	s	,l	.s	,f	:m	m'	.d'	:r'	.d'	,t
1st TREBLE.	m	.m	:m	.f	,f	m	,f	.m	,r	:d	s	.s	:t	.l	,s
BASS.	d	.d	:d	.d	,d	d	,d	.d	,t,	:d	d	.m	:s	.fe	,s

ham - mer, fall - ing fast; Tap, tap, tap! from the morn - ing's ear - ly light,
arm must wea - ry be; Tap, tap, tap! hap - py with his hum - ble lot,
chil - dren dear are fed. Tap, tap, tap! this the thought his arm that nerves,—

	l	,t	.d'	,r'	:t	r'	.s	:m'	.r'	,d'	r'	,d'	.t	,d'	:r'
	fe	,s	.l	,fe	:s	s	.s	:s	.s	,s	t	,l	.s	,l	:t
	r	,r	.r	,r	:s	t,	.t	:d'	.m	,m	s	,s	.s	,s	:s

Tap, tap, tap! till the dark - 'ning shades of night. Tap, tap, tap, tap,
Tap, tap, tap! on he works and mur - murs not. Tap, tap, tap, tap,
Tap, tap, tap! that he works for those he loves. Tap, tap, tap, tap,

	m'	.m'	:r'	.d'	,t	l	,t	.d'	,r'	:s	d'	.s	:d'	.s
	s	.s	:s	.fe	,s	fe	,s	.l	,fe	:s	m	.m	:m	.m
	d	.d'	:t	.l	,s	r	,r	.r	,r	:s	d'	.	:d'	.

tap, tap, tap! Tap, tap, tap, tap, tap, tap!
tap, tap, tap! Tap, tap, tap, tap, tap, tap!
tap, tap, tap! Tap, tap, tap, tap, tap, tap!

	l	.d'	:s	.	m'	.d'	:l	.	t	.r'	:d'
	f	.f	:m	.	s	.s	:f	.	r	.f	:m
	f	.l	:d'	.	d	.m	:f	.	s	.s	:d

The Practical Teacher.

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Publications Reviewed.

Lectures on Teaching. By J. G. Fitch, M.A. London: Cambridge University Press.

We have received from the Cambridge University Press Warehouse this new and cheaper edition of Mr. Fitch's 'Lectures on Teaching.' When the book was first issued it was fully noticed in our columns. We need now only add, that in our opinion, it is a work so excellent that every teacher should study it.

The Dictionary of Education and Instruction. New York: E. Steiger and Co.

This is an admirable 'reference' volume, worthy of our warmest praise, and which we wish we could see on the shelves of every pupil-teacher's library in the kingdom. Its chief aim is to supply a brief compendium of the theory and practice of education in a series of clear and definite articles, alphabetically arranged so as to be easily referred to, or systematically studied; to encourage in this way the study by teachers of the principles and practice of their profession, thus giving to the work of education a greater degree of intelligence and efficiency; and to afford a convenient class manual of pedagogy for use in normal schools and teachers' institutes as the basis of a course of instruction in principles and methods, not necessarily superseding other valuable manuals differently arranged, but accompanying and strengthening them. The articles are from the pens of the best writers, both on this and the other side of the water.

Halfpenny Maps. London and Belfast: Marcus Ward and Co.

For want of a better title we thus refer to a series of excellent maps clearly printed in colours and highly finished. Those before us comprise *Europe*, *India*, *Germany*, *Canada*, *Oceania*, *Australia*, *New Zealand*, and *Central America*. Doubtless, England and other portions of the British Isles will be added, if not already forming part of the series, and also France, Italy, Spain, Turkey, Norway and Sweden, and Russia. But from the examples before us, nothing more can be desired in the way of a correct, clear, and beautiful map on a small quarto scale. The printing, or rather engraving, is very clear and distinct, and the colouring most carefully finished.

The Simple Outline of English History. For Standard IV. London: Cassell, Petter, and Galpin.

This book answers to its title of being an outline of English History, and in this displays considerable skill in the way of condensation and arrangement. The outline is also drawn with remarkable evenness of style and general freedom and fairness. But the introductory part has the usual commonplace errors about the Britons, who, according to the compiler, were 'naked savages' when invaded by the Romans. The Saxons, we are told, 'were cruel and bloodthirsty in their fighting, and when they won a battle they slew all their enemies who fell into their hands, except a few whom they kept to be their slaves.' Now, the *theowes* or *servi* among the Anglo-Saxons were persons taken in war and criminals irrespective of race. No competent historian identifies them with the Ancient Britons. Even these *theowes* were not hopelessly shut up in perpetual bondage. But the Britons were to be found largely among the classes of freemen and even Thanes. 'As a race, the Britons were not merely allowed to continue on the conquered territory, but tempted to do so by various advantages.'* They continued to reside in towns of their own, though in many cases these towns were subjugated by the Teutonic tribes. In these towns the Britons continued to live under laws and magistrates of their own and within the bounds, too, of the victors' jurisdiction, as was the case with the *Wealas* of Wessex (at Exeter) until the time of Athelstan's extension of the West Saxon dominions. Doubtless, many British captives taken in battle were put in the rank of *servi*, but only as Saxons, Angles, or Danes were also put under similar circumstances. Unless taken as prisoners of war or convicted of great crimes, the Britons generally belonged to the different classes of

* Dr. Nicholas.

ceorls. Doubtless, also, much, though certainly not all, of the land was taken from the Britons by the successful Angles and Saxons. In the laws of King Ina, compiled at the close of the 7th century, we have the Wealas proprietors of various degrees, and chargeable with *wergild* on a 'hide' of land or more. Further, it is provided that the Wyliscman who should possess five 'hides' of land should enjoy the rank of Thane, the same qualification for the Saxon's advance. Many other proofs might be adduced to show that the Britons and Saxons were on the whole treated alike, and that the servile or exterminatory theory is unsupported by anything like proof. The printing of this book of *Outlines* is clear and good, and the illustrations ample and appropriate. Among them is the upper part of the figure of Henry VIII. from the fine portrait at Petworth. Altogether the book is most readable and free from masses of dates and names, which in such a compendium would be quite out of place. The maps are clear, good, and instructive.

Cassell's Book of Sports and Pastimes. London: Cassell and Co.

This is a capital interesting serial, whose contents are aptly described in the title.

Friar Hildebrand's Cross; or, the Monk of Tavystoke Abbaye. By M. A. Paull. Hodder and Stoughton.

This is a fairly well-written story, in the way of a fragmentary autobiographical record concerning a sixteenth-century monk, who had quite mistaken his vocation, which therefore became a *cross* to him. For Hildebrand is not only inclined in a distinctly sensuous, albeit innocent, way to all the intellectual pleasures of this life, as painting, and music, and flowers, and scenery, and so forth, but also he falls violently in love with one Cicely, his own scholar, a very charming Queen of the May, who, however, honestly marries a handsome young miller, and has as her firstborn a namesake Hildebrand, as her second a Cicely: all which are manifestly nails in the cross of our stricken and yet pious friar. The end of the story is that Martin Luther's Reformation comes on about that time, and King Harry destroys the monastery, dispersing its inmates, after their 600 years of monkery, and our now semi-Protestant friar emigrates to Compoella in Mexico, dying some years after in the arms of his young namesake who accompanied him. The story is of good humane interest, as illustrative of a heart almost literally crucified by a compelled celibacy, that old normal tyranny of the monastic system.

The volume (well printed and tastefully bound) is swelled into a larger bulk than the biography, by some so-called MSS. 'found' in a chest of 'ye Abbaye' by our monk, detailing sundry not very interesting historical events from time to time, in an imitated archaic phraseology, which consists chiefly in the transmutation of the letter i into y, and in adding an e at 'ye ende ofe manye a worde,' which does not deceive the modern reader nor improve the antique style. An extract or two from the book may serve to illustrate our fair criticism, as thus: Hildebrand's Romish idolatry is shown in the carved image he has made of St. Cecilia, which he avouches (p. 335) to be that of Cicely herself—'Cannot Cicely trace her own fair image in that lovely form? will she never guess of all my tenderness, my faith, my sacrifices, my cross? alas, never!'

His sensuous love of Nature is frequently shown, as thus: 'What glory and beauty exist in men alone; what infinite pleasure I have experienced many a time in the rich carmine, and amber, and azure, and emerald hues with which I illuminate; I have rendered a devout thanksgiving upon bended knees for the tints of a sunset,' etc., etc. . . . . Again: 'We monks, who shut out the common passions of humanity from the heart, do not therefore necessarily become pure; but, alas! very often give only the more place to the gluttony, the avarice, the pride, the superstitions, that are abhorrent to our Master Christ.'

On the whole, the author, or authoress, is to be commended for a wholesome and interesting story which, it is to be hoped, will find a welcome among many readers.

The History of a Lump of Coal. By Alexander Watt. London: A. Johnston, Paternoster Buildings.

We opened this book with interest from having read with pleasure other scientific brochures by Mr. Watt. On the whole we are not disappointed, though we fail to follow Mr. Watt in attributing the formation of coal to the Noachian Deluge. Mr. Watt supposes 'that while this terrible effect of Divine wrath was being consummated, countless millions of trees' . . . . were uprooted, floated on the waters, became deposited in the valleys on the subsidence of the waters, and 'in process of time' would undergo those slow changes so as to become converted into beds of petrified or fossilized organic matter, which we now call coal. Though we have condensed, we have not misrepresented Mr. Watt, and leave geologists to smile at this novel way of accounting for the coal formation, which lies far beneath the Tertiary strata, and for the top of which, the alluvial beds of clay and Bagshot sands, they require a period of several millions of years!

Leaving—as it had better be left—this fanciful dragging in of the Biblical Deluge, we proceed on safer ground to question Mr. Watt's fears for the not very distant exhaustion of our coal beds. Certainly the consumption is enormous, notwithstanding a great strike or two now and then, but we have lately had satisfactory assurances of the probable existence of fields upon fields, which may lessen anxiety for some 50,000 years at least.

Mr. Watt traces the history of gas and other products of coal interestingly and succinctly. Gas, we learn, after being successfully used by Mr. Murdoch in his house at Redruth was used in public at Birmingham on the occasion of the National Illumination for the Peace of Amiens in 1802. In less than twenty years after this its adoption was general. William Murdoch has, however, as Mr. Watt remarks, been almost forgotten.

The discovery, however, of the wondrous wealth of colouring matter in the once despised and worthless coal-tar forms as may be supposed the most interesting portion of Mr. Watt's book. The brilliant colours of which mauve and magenta had the first run have almost revolutionized the art of dyeing, by acting on the fabrics directly and without the intermediate process of 'mordanting,' or dyeing with a preliminary colour. The preparation of the intense and brilliant colours, of which the aniline group is the principal, Mr. Watt well describes, and believes there are yet more discoveries to be made in addition to those by which immense fortunes have been obtained.

Altogether Mr. Watt has given us a most readable collection of the information connected with our 'black diamonds.'

Blackie's Sixth Geographical Reader. By W. G. Baker. London: Blackie and Sons.

This book, taking up Asia, Africa, and America, is certain to take a leading position among the most useful of school books. It differs favourably from most geographies, which, however meritorious as compilations, seldom contain a touch of lively description or animated colouring. The book before us, while giving all needful facts and figures, comprises attractive and readable sketches of people, scenery, and other features that make up the best books of travels. In addition to these lively and always appropriate selections, Messrs. Blackie have given a series of physical maps of unusual excellence. By skilful and artistic touches the engraver gives us a clear picture by way of a map of mountain valley, river,

and plain. From these maps alone clear notions of physical features are obtained at a glance. Further, we have a liberal supply of other illustrations, all appropriate and helping much to ensure the retention of the knowledge conveyed by the letterpress. In China, for example, we have a capital picture of a 'Tea Plantation,' in which the natives are gathering the leaves from the small shrubs, while being overlooked by a fan-bearing proprietor. Beyond is a river on which junks are sailing, and in the distance a pagoda. In the descriptive sketches Colonel Burnaby is largely quoted, and the best writers on several other countries. A summary is appended, in which a vast number of facts are epitomized in about half-a-dozen pages. The book is worthy of the highest praise.

General Biology. By E. B. Aveling, D.Sc. London: Stonecutter Street.

This work is stated to be specially adapted for the Elementary Examination in General Biology of the Science and Art Department, South Kensington. We cannot think, however, that the author has been happy in his attempt at producing a text-book for this Examination. The book presents a large mass of information, much beyond the requirements of Elementary Biology; and this information is presented in an extremely condensed form, reminding one of lecture-notes requiring further elaboration and explanation.

The whole treatment of the subject is suitable rather to the requirements of the advanced student and teacher, than of the boy beginning the study of science. The technical words used are generally explained, and their derivation given; but occasionally we meet, with difficult words unexplained: such as 'homology,' 'analogy,' 'excrementitious.'

We would specially recommend the book to the favourable notice of those studying Biology for the intermediate B.Sc. examination. It would also be useful to teachers requiring an accurate and complete *resumé* of the Science Department syllabus.

To be of use for young pupils, however, it will require much simplification, and, what is more important still, the addition of illustrations.

It is true that the methods of observing the *things themselves* are here described; but pupils too commonly do not know what they are to see, and whether they see the right thing, unless some illustration is given to guide them.

The book is clearly printed, and on the whole singularly free from printers' and other errors.

On page 81 we note that chara and the fern are described as flowering plants. Doubtless this is an accidental mistake.

On page 12 degrees of temperature are mentioned without stating what scale is used; as the centigrade scale is mentioned on page 18, we presume this is intended throughout.

In a book intended for young students, it would have been better to mention the English equivalents of millimetres, though we quite agree as to the desirability of stating all measurements in the metric system.

The author's tendency to introduce debateable matter is on the whole kept well in the background, though it creeps out occasionally. Thus we have a comparison instituted between the Bronnian movements in inorganic particles suspended in water, and the oscillatory movements in the 'stijl-stage' of Bacteria.

A 'cell' is defined on page 35 (after considerable use of the name without a definition) as 'a mass of protoplasm surrounded by a definite wall, and enclosing a more solid portion known as nucleus.'

The term 'plastid' is used to imply a mass of protoplasm without an enveloping cell; and 'cytod,' a mass of protoplasm enveloped by a distinct wall, without a nucleus Such a limitation of the meaning of 'cell' is extremely unsatisfactory, especially as it obliges us to banish the term from Animal Physiology, and so creates confusion in our terminology. Prantl and Thomé do not recognise such a definition of cell, but regard the presence of protoplasm as the only necessary element; the presence of nucleus and cell wall, or their absence, constituting important varieties of cell.

The description of each organism is placed under fixed divisions, which are valuable as ensuring a systematic study.

In the description of Bacteria we have the following:—'(*d*) Circulation.—In this connection nothing is to be said.' This very ambiguous statement evidently assumes the acquaintance of the student with the fact that Bacteria have no circulatory apparatus, an assumption which no good elementary teacher would make.

We are told that if a white corpuscle is carefully watched under the microscope, it will be observed to undergo slow alterations of form. This statement, unaccompanied as it is by any further explanation, would certainly lead to disappointment on the part of a student who thus watched a corpuscle. The fact that a warm stage is required (temp. of 50 °C.) ought to be insisted on, as well as that even then the movements are extremely slow and difficult to trace.

There are some very useful tables throughout the book, as of the differences between a fern and a flowering plant, the classification of vegetabilia, etc.

At the end of the book is a useful glossary.

Animal Physiology. By A. Willis. Adapted to the Requirements of the Education Code. Stage I. R. J. Derfel, Manchester.

We are sorry to have nothing good to say concerning this pamphlet-like book. A first glance through it shows that it bristles everywhere with technical words, and these are used to such a superfluous extent that we are bound to say, that if we wished children to imbibe a dislike for the study of physiology, the first step we should take would be to place this book in their hands.

These technical terms are much more numerous than the requirements of an elementary text-book necessitate. What need, for instance, to talk of 'sarcolemma,' 'orbicular ligaments,' 'gastrocnemius and soleus muscles,' 'foramen magnum,' etc., etc., in a book intended for boys and girls of a tender age? Surely none of her Majesty's inspectors could require a knowledge of such words as these! So anxious is the author to give everything a technical name, and so impressed is he with the importance of not calling a spade a spade, that even ribs are dignified with the name of 'costæ.' Surely this is going too far! In Gray's 'Anatomy,' the standard work for medical students and others who have to study the structure of the body in great detail, 'costæ' are not so much as mentioned.

Looking through this book more carefully, we find it not only bristling with technicalities, but full of inaccuracies and misstatements. Here are a few specimens.

On the first page the ligaments are described as being *elastic fibres*. This is true of one or two sets of ligaments, as the *ligamenta subflava* of the spinal column, where they are elastic for a special object. But in all other cases the ligaments are pliable but almost perfectly inextensible; so much so that the fibres in cases of injury will rather rupture than stretch. If it were not so, dislocations would be much more frequent than they now are.

There is a full figure of a skeleton on the second page. We would recommend the right knee to the notice of the artist. The joint is considerably deformed, and looks as if the subject depicted had suffered from rheumatism for many years.

The side view of the skull on the next page is extremely sketchy and inaccurate. The frontal bone sticks out in the shape of a knob that would delight phrenologists, but is certainly not normally present; on the malar bone is another knob which does not exist except in the imagination of the artist; while the sigmoid notch of the lower jaw is much too shallow.

'But it is quite accurate enough for children,' will be said. We have no sympathy with such a slovenly excuse for inaccuracy. Children who see these illustrations will imagine that they represent the truth, and thus false teaching will be imparted, very difficult to eradicate.

Resuming our invidious task of pointing out errors—in the next illustration, figuring the thorax, we find the sternum carefully divided into six segments by transverse lines. In the adult condition there are only three segments, the fœtal six segments having become fused.

We learn for the first time, as is stated a little further on, that there are nine *false vertebræ*. It is true that the sacrum and coccyx are composed of nine fused vertebræ, but to call them false vertebræ (unless on the ground that they are generally known by this name) is useless.

The pelvis is said to be composed of the two *ossa innominata;* as a matter of fact, it consists of these two bones *plus* the sacrum and coccyx. Three of the false ribs are stated to be joined together at their ends, and then to the sternum by a band of cartilage. This is incorrect. They are joined on to the seventh rib which articulates (some distance away) with the sternum.

The *trunk* is said to be composed of vertebræ, ribs, sternum, scapulæ and clavicles. The two last do not belong to the trunk, but to the upper extremity. The leg is said to consist of femur, tibia, etc., the os innominatum being omitted. Where, then, shall we put this bone? does it belong neither to the trunk *nor* to the leg?

The tibia, we are told, 'received its name from the resemblance it has to a musical instrument (Lat. tibia = flute).' The author has only got hold of half the truth here, the resemblance between the triangular tibia and a flute is surely very remote! The real origin of the name lies in the fact that flutes were formerly made out of *hollow* bones, like the tibia.

The tarsal bones are *laterally* articulated with each other, we are told. This expresses just half the truth. Too much detail ought not to be given in an elementary book, but what is given ought to be accurate. The omission of the word 'laterally' would have made the sentence true, and not half true.

The list of inaccuracies in the description of bones is not exhausted, but let us turn to the muscles. They are described as consisting of a number of fibres, connected together in bundles, and these bundles enclosed in sheaths of *sarcolemma*. This is grievously incorrect. The sheath binding the muscle-bundles together is generally called 'perimysium,' but it is a word we should be sorry to use in teaching children. Sarcolemma is the sheath of each individual fibre, not of the bundles of fibres, and much less binding these bundles together.

Turn to the skin. It consists of an outer layer or cuticle, and an inner layer or cutis. Immediately below the outer layer, we are told, are the pigment cells. This is grossly inaccurate. The pigment cells are in the *rete mucosum*, or deeper part of the outer layer.

We will not attempt to describe the section of skin depicted. It makes one's hair 'stand on end,' by a mechanism that is not accurately drawn in the diagram.

The diaphragm is described as a *flat* muscular partition.

The thorax is said to contain the organs of circulation and respiration; and the abdomen, the organs of alimentation and excretion. Now the organs of excretion are the lungs, the skin, and the kidneys. As the lungs are in the thorax, and the skin, *not* in the abdomen, the inaccuracy o such a classification is obvious. The description of the abdominal organs would surely confuse and mislead a most intelligent boy. The size of the liver is not given; and the pancreas is stated to be a *large* oblong gland. The natural inference would be that the pancreas is larger than the liver.

The kidneys are stated to be the only organs in the abdomen outside the peritoneum. As a matter of fact there are *no organs inside* the peritoneum, which is a closed sac; but if the author means that the kidneys are the only organs not *surrounded* by peritoneum, he is again inaccurate. Part of the rectum and duodenum, part of the bladder, and the suprarenal bodies, are uncovered by peritoneum.

The function of the pancreas is stated to be to digest starch and fat, and no mention is made of the infinitely more important action on proteids.

Such are a few of the mistakes to be found within the small compass of this book. We leave teachers to decide whether it is a reliable handbook in the study of the science which it professes to teach.

The New Code, with Explanatory Notes and a Copious Index. By T. E. Heller. London: Bemrose and Sons.

To praise this book (which, by the way, includes the 'Instructions to Inspectors,' and other official forms and documents), compiled by Mr. Heller, would be a work of supererogation. No man living is better fitted to annotate the Code than the Secretary of the National Union of Elementary Teachers, who, we scarcely need add, has done his work conscientiously and well.

The Children's World. By E. M. M. London: A. Johnston.

This pleasant lecture was arranged for the author's children and little friends, and by request has been printed for the benefit of those who may wish for their children an easy method of enabling them to remember many common facts relating to the world. It is short interesting, and instructive.

Johnston's General Knowledge Charts. Compiled by W. Stephen. W. and A. K. Johnston, Edinburgh.

This is a well-arranged and useful series of charts, four in number, mounted on roller, ready to be hung on the walls of any schoolroom. We think they will prove acceptable to many teachers, as they contain just what is wanted for school work. Sheet No. 1 deals with Great Scientific Discoveries, and those who have been mainly instrumental in investigating them. No. 2 contains a list of the most celebrated British Historians and the chief points of interest connected with them and their works. Sheet 3 is devoted to Distinguished Inventors, their Inventions, and the main incidents of their lives: and Sheet 4 contains a chronologically arranged list of our best known Poets, their leading dates, and chief works. Clearness of printing and arrangement is not one of the least valuable features of the series.

The First Six Books of the Elements of Euclid, with Copious Annotations and Numerous Exercises. By J. Casey, LL.D., F.R.S. Dublin: Hodges, Figgis, and Co.

The preface states that this book 'is intended to supply a want much felt by teachers at the present day—the production of a work which, while giving the unrivalled original in all its integrity, would also contain the modern conceptions and developments of the portion of geometry over which the elements extend.'

The book is all and more than all it professes to be. It forms a capital introduction to the modern methods of geometry.

The propositions suggested are such as will be found to have most important applications, and the methods of proof are both simple and elegant. We know no book which within so moderate a compass puts the student in possession of such valuable results.

Perhaps the exercises left for solution are somewhat difficult, but they are all such as will repay patient study, and those whose solutions are given in the book itself will suggest the methods by which the others are to be demonstrated.

We recommend every one who wants good exercises in geometry to get the book and study it for themselves.

The book is well printed in large and clear type; the figures are well drawn, and the general get-up of the book leaves nothing to be desired.

Longmans' Modern Copy-Books. London: Longmans and Co. No. VII. Double Small Hand; VIII. Double Small and Text; IX. Double Small (Narrative). X. Small Hand. XI. Small Hand—Invoices, Business Forms, etc. XII. Correspondence, etc.

Provision is made in the first three of the above books for the work of Standard III., and the remaining numbers are designed for the upper standards. We presume these capital writing-books were planned prior to the issue of the newest of new codes, as in Standard III. there are neither exercises in large hand nor figures, both of which are prescribed in the document which will hereafter be associated with Mr. Mundella's name. Of the character of the writing, however, we cannot speak too highly. Perhaps the best praise we can give it is to say that it is just what the Education Department asks for. In the selection of the subject-matter, and in the general arrangement of these books, sound judgment has been shown. Messrs. Longmans' modern copy-books can fairly claim to rank amongst the best in the market.

Longmans' Modern Arithmetics. Standards V., VI., and VII. Answers to Standards I.-VII. London: Longmans and Co.

We advise teachers who contemplate a change of arithmetics when their inspection is over to examine this new series before making a final choice. They will find here numerous graduated examples, accompanied by short, clear, and comprehensive explanations of rules, etc. To the children who of necessity attend school irregularly, and have to pursue their studies at home, these explanations will prove invaluable. Candidates and young pupil-teachers who work through the higher books will find themselves all the better equipped when their annual examination comes round.

White's Grammar-School Texts. (1) Xenophon's Anabasis. Lib. VII. Longmans.

Schoolboys in this happy nineteenth century may well thank Dr. White for the easy ladders whereby they can climb the hill of knowledge: both in this instance and in the notice immediately following, the road to Parnassus is cleared of rocks and is strewed with roses. One of the books of Xenophon's famous 'Cyric Travel' is here beautifully printed, with a glossary of every word fully expounded in English, etymologically and grammatically. How different from the old day when our Schrevelius explained hard Greek in harder Latin, and several big volumes had to be examined, for the knowledge now contained in one small handbook bound up with the text.

(2) Virgil's Æneid. Lib. XI. Longmans.

Parents and teachers, as well as their children and scholars, can equally bear out the justice of our remarks above. There is absolutely nothing to be desired in the way of *practical teaching* which such manuals as these do not efficiently supply. Virgil, as well as the old Greek historian above mentioned, is here made easy to the English schoolboy, whilst instead of heavy and expensive crown octavos, one little 16mo gives all the literature necessary at minimum cost.

The Fifth Illustrated Reader. Longmans' Modern Series. London: Longmans and Co.

This book is well fitted to take a leading place among School Readers. It is varied, interesting, and calculated to invite youthful readers to acquire more fully knowledge in the paths it opens. While Milton, Shakspere, Scott, and other great writers are not forgotten, we have extracts from newspapers, magazines, and other modern sources selected with judgment and good taste. Not the least attractive to boys will be the capital cricketing lines, entitled, 'Nat Ricket.' A charming prose sketch, 'The Story of the Year,' is from the ever-pleasing pen of Hans Andersen. The book is also excellently printed and suitably illustrated.

Selected Plays from Shakspere. By S. Brandram. London: Smith, Elder, and Co.

We congratulate Messrs. Smith, Elder, and Co. upon the timely issue of the following neatly-bound, abridged plays:—'The Merchant of Venice,' 'Romeo and Juliet,' 'A Midsummer Night's Dream,' 'Much Ado about Nothing,' 'Twelfth-Night,' 'As You Like It,' 'Hamlet,' 'Macbeth,' and 'The Tempest.' They have been compressed and adapted for school use by Mr. Brandram, so well known to the world as a successful Shaksperian reciter. Teachers in our public elementary schools would certainly have set more value upon the books as school-readers if a few simple explanatory notes had been appended. We heartily commend Mr. Brandram's plays.

Essay on Lord Clive. By Lord Macaulay, with Introduction and Notes by G. B. Turnbull, M.A. London and Edinburgh: W. and R. Chambers.

We have pleasure in recommending this little edition of one of Macaulay's most interesting essays, and congratulate Mr. G. B. Turnbull on the manner in which he has compiled the notes. They are concise, thorough, and satisfactory in every respect.

Chaucer: 'The Squiere's Tale,' with Life, Grammar, Notes, and an Etymological Glossary. London and Edinburgh: W. and R. Chambers.

This little book is complete in itself, and its possession will enable the student to thoroughly study this work of Chaucer's without the trouble of referring to other text-books. From the Life of Chaucer at the commencement to the Glossary at the end, all the contents are thoroughly satisfactory.

Shakspere's 'King Henry V.' London and Edinburgh: W. and R. Chambers.

It is a pleasure to meet with this book. The notes, to which additional clearness is given by change of type, are clear and concise, exactly fitted for school use, and the Examination Questions at the end will prove valuable to students and teachers alike.

Facts to Impress, and Fancies to Delight. London: Partridge.

A pretty little gift book for the young, comprising five short biographies, five historical notices of castles and abbeys, and eight simple stories, each of the eighteen subjects being illustrated with suitable woodcuts, all being neatly printed and tastily bound, and quite a bargain at one shilling and sixpence. As to any critical remark, of course there must be much of omission in such scant sketches of famous men; and in the story department it is a pity to have named a dissolute (though finally repentant) young man Walter Raleigh. Such a misnomer—for he might just as well have been styled John Smith—confuses biography in the young mind in tale-telling as much as geography is confounded in America by, for example, the New York State propinquity of Ithaca, Syracuse, Batavia, and Buffalo. But perhaps this is hypercritical, and it need not affect our kindly commendation of Mr. Frederic Gammon's little book.

Our Little Ones. London: Griffith and Farran.

This superbly illustrated magazine maintains its general excellence. We are glad to see that Mr. Crampton, he veteran song writer, is now on the staff.

The Children's Daily Help for the Christian Year. London: Griffith and Farran.

This little book will, we think, prove welcome in many families, for the printing being clear and the type large, it is suited to young learners, and the texts and verses have been selected with evident care and skill.

What Her Majesty's Inspectors Say. By T. R. Clifford. Darlington: North of England School Furnishing Co.

This excellent digest of the Blue-Book makes its appearance for the third time, and we accord it a hearty welcome. Mr. Clifford has taken exceptional pains to render his work trustworthy and useful, and in this he has thoroughly succeeded. Every one interested in education should possess a copy.

Christmas and New Year Cards. London: Hildesheimer and Faulkner.

The struggle between manufacturers seems to be becoming more intense every day. At least that is the only way in which we can account for the perfection of the specimens before us. As examples of lithographic skill they can hardly be excelled, and we have great pleasure in recommending them to the notice of our readers. Some of the larger cards are 'gems' in delicacy of colouring and in elegance of design, and one wonders how so much science and skill in art can be expended on so cheap an article with any degree of profit.

Science Notes.

A NEW FORM OF THERMOMETER.—M. Michelson has brought before the French Physical Society a new form of thermometer, for which he claims so extraordinary a sensitiveness that he hopes by it to measure intervals of temperature of not more than one-thousandth of a degree centigrade. The principle of the bimetallic thermometers is the basis on which the instrument is constructed, but instead of two metals being used, M. Michelson adopts ebonite and platinum. Ebonite is more than ten times more dilatable than platinum, and a spring composed of the latter on one side, and the former on the other, will curve with the slightest addition of heat. At the extremity of the spring, instead of a pointer working along a scale, is fixed a glass stem, which touches a mirror suspended by a single fibre of unspun silk. By every change in the curvature of the spring, the mirror is moved, and a ray of light reflected from its surface moves up and down the divisions of a scale.

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THE LATE PRESIDENT GARFIELD.—Even after the lapse of what in the present rapidly moving age is a considerable interval of time, the subject of President Garfield's untimely fate always excites a melancholy interest. The celebrated surgeon, Professor Essnarch, has lately published a lecture which he delivered some months ago before the Physiological Society of Kiel, on the treatment of the wound. He maintains that it was not necessarily mortal, and that the injured vertebra could have been healed. Death resulted, he thinks, from the way in which the antiseptic treatment was applied, together with the mistake of searching for the bullet. He argues that the example of Von Langenbeck, in the case of the German Emperor, should have been followed, and the bullet allowed to remain. Had this been done, and the antiseptic treatment rigorously applied, he maintains that a fatal issue would have been avoided.

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SCIENTIFIC CHEESE-MAKING.—The inquiry has often been made why the different sorts of cheese we have vary so greatly in flavour. Those made in different districts have marked characteristics that distinguish them sharply from each other, although they may all be made in precisely the same manner. On the other hand, the different sorts, so readily recognisable by the palate, may be made in very different ways. The distinction between different kinds seems therefore to be local, and to depend upon circumstances other than the process of manufacture. This idea is borne out by some very interesting experiments made by a French chemist, Mons. E. Duclaux, who set himself to discover the causes which determine the flavour of cheese, and the causes of its variation. His researches tend to prove that neither climate, soil, food, manipulation, nor variety in the breed of the cows, largely affects the quality of the flavour, but that the secret of the differences must be looked for in a lowly organism. A fungus or mould is communicated by germs in the atmosphere to the cheese in the course of its manufacture, and with the nature of the ferment so supplied the taste of the mature cheese is associated. The fungus he found to vary in different cases, in some being allied to the yeast plant, in others to the common mould.

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EXTINCTION OF FIRE.—Many have been the efforts of chemists and engineers to produce some means for the rapid extinction of a conflagration that shall be speedy, certain, and of such a nature as not to cause almost as much damage to goods as the enemy it seeks to quell. It is well known that in the case of many fires as much loss is caused by the water poured into the seat of the evil as from the direct action of the flames. We have had, hence, machines patented supplying water in small quantity, but that water charged with a large volume of carbonic acid, the effect of which has been rapid and certain. Now another claims attention, and puts its powers forward to bid for our support. This is an engine known as 'Vinning's Patent,' and it delivers water highly charged with compressed air. Recently a public trial was held upon a vacant piece of ground at the City end of the Thames Embankment, which resulted in a successful demonstration of the fact that a fiercely burning fire can

be as effectually and speedily suppressed with plain water thrown at a high pressure as with water charged with carbonic acid or other chemical agents which have hitherto been employed. The engine is made of wrought copper, and as no chemicals nor acids of any kind are required, the inventor claims that it is entirely free from the rust and corrosion which make all chemical engines such short-lived appliances. The chief difficulty which has proved fatal hitherto to the success of the compressed-air extinguishers is their liability to leak under the long-standing pressure exerted over the whole of the apparatus. This difficulty the inventor claims to have overcome by an arrangement through which the air pressure is brought to bear upon the water only when the engine is to be used. It can be charged in five minutes by means of the air-pump, up to a pressure of 100 lb. to 140 lb. per square inch. In the experiment tried, the material was purposely of the most inflammable description possible, being composed of shavings and straw, enclosed in roughly built shanties or frameworks of wood, and the whole saturated with paraffin. The flames made havoc at once with these, but the effect of the charged water was to rapidly check and very soon entirely extinguish them.

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A NEW ICE-MAKING MACHINE.—The transition from the consideration of fire to that of ice is natural and easy, but while the *extinction* of the one is a desideratum, the *production* of the other is the point of interest. The Aylesbury Dairy Company have recently brought before the public some elaborate machinery for this purpose, which was recently tried with considerable success on their premises at Bayswater. It is known as the 'Patent Vacuum Pump Refrigerator,' and it is claimed on its behalf that it excels any existing machinery in maintaining a vacuum for manufacturing and chemical purpurposes, for cooling water on a large scale, and for making ice of great purity and lasting character. It is said that in hot climates the machine will have a distinct advantage over its rivals, as it may be worked there effectually and economically. With regard to the mode of action, it should be borne in mind that in a vacuum below five millimetres of absolute pressure water evaporates to the extent of about one-sixth of its quantity, and by the process of evaporation robs the other five-sixths of so much heat as to turn it into ice. The nearer the rarefaction in the freezing chamber employed approaches to the point of an absolute vacuum, the quicker is the evaporation, and the greater the cold under which the ice forms. In the engine used, the air-pump establishes a vacuum in the cylinders in which the water is to be frozen. The water is then conducted into these cylinders, the air contained in the liquid is set free, and forms with the vapour from the one-sixth of the water a mixture, which, to preserve the necessary vacuum, must be rapidly removed. The mixture before reaching the pump passes over concentrated pure sulphuric acid in a cylinder where the moisture is absorbed by the acid, and the air-pump has only a little dry air to remove. The remaining quantity of water left in the cylinders is turned into ice, and when a sufficient quantity is obtained, say 6 cwt. in one cylinder, the blocks are allowed to fall by their own weight into a cellar or other receptacle below, by the mere unscrewing of the hinged floor of the cylinder, and the admission of air. The whole work of the production and discharge of the ice is performed by the apparatus, and for a machine which produces 12 tons of ice in twenty-four hours, the services of only one man at a time are required. The machine consequently involves a much cheaper production than any other machine in use. The item of steam power required to make the ice is also less than in other engines, only about 1½ lbs. of coal being used in the manufacture of a ton of ice. The machine has been already successfully used in the cooling of water for breweries and chemical factories, and in the manufacture of soap, candles, and chocolate.

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THE CENTENARY OF BALLOONING.—From a book called the 'History of the Academy of Sciences' for 1783 it appears that the first trial of the invention of the balloon by the elder Montgolfier was made at Avignon in the course of the month of November, 1782. The French Academy of Meteorological Aerostation has decided to celebrate the hundredth anniversary of this event by a public banquet. It is interesting to compare with the monster vehicles now in use the description of Montgolfier's balloon. It was constructed of silk, was in the shape of a parallelopiped, and had a capacity of only forty cubic feet. It was inflated with air, and ascending power was given to it by heating its contents by means of a fire of paper suspended beneath its opening.

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MARSH FEVER AND SULPHUR.—A French chemist, Mons. d'Abbadie, has made a communication to the Academy of Sciences in Paris, in which he draws attention to the efficacy of sulphur in preventing the propagation of marsh fever. It has been observed by travellers, he says, that the elephant hunters in Ethiopia are not affected by the most unwholesome air, and that they are in the habit of fumigating their bodies daily with sulphur. Professor Sylvestri, of Catania, in Sicily, a district famous for its sulphur mines, stated in answer to questions from Mons. d'Abbadie that intermittent fever was never fatal in that locality. Moreover, in the surrounding villages 90 per

cent. of the population were attacked by the fever, but in the sulphur-producing villages the proportion was only from 8 to 9 per cent.

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RECENT BOTANICAL WORK.—The past year has been very noteworthy from the many important investigations that have been made by the leading German botanists into the intimate constitution of vegetable organized structures. Lately researches have been published which lead for the first time to a satisfactory explanation of the processes of the thickening that take place in the walls of cells, and which clear up the hitherto confused questions of the appearances known as striation and stratification. The formation of starch also in the cells of the plant has received further elucidation, and the little masses of protoplasm or amyloplasts, which were last year discovered to be the centres of origination of starch formation in the parts of plants not exposed to light, have been ascertained to differ only in respect of colouring matter from the chlorophyll corpuscles which form the starch in the leaves under the action of light. Finally, further investigation as to the part played by the chlorophyll in this starch formation and in the decomposition of carbonic anhydride proves all the theories yet advanced as to its mode of action to be erroneous, and to show that this is a question that must engage the attention of scientific workers for some time yet to come.

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MYSTERIOUS RELICS IN THE SOUTH PACIFIC.—The following interesting account is from the *Leisure Hour*:—"The island of Rapa Nui owes its interest to its mysterious relics of a forgotten race, who have utterly and completely died out even from legendary lore, while their handiwork abides, written on the rocks, which are so covered with carving as to resemble the studio of some giant sculptor. Colossal stone images lie half buried beneath the creeping grass and encroaching scrub. They are all hewn of a close-grained grey lava, which is only found at Otouli, a crater on the east side of the island. On a platform near this quarry several gigantic images stand in perfect preservation. One of these measures twenty feet from the shoulder to the crown of the head. They represent an unknown type. Very square face—short, thin upper lip, giving a somewhat scornful expression—broad nose, and ears with pendant lobes. All the faces look upward. The eyes are deeply sunken, and are supposed to have originally had eyeballs of obsidian. The statues are literally lying about in hundreds, and the very rocks on the sea beach are carved into strange forms—tortoises or human faces."

Publications Received.

Animal Physiology

(1) Willis's Animal Physiology. Stage I. R. J. Derfel.

Biology—

(1) Dr. Aveling's General Biology. 28, Stonecutter St., E.C.

Book-keeping—

(1) Sheriff's Single Entry. Allen and Co.
(2) Sheriff's Double Entry. Allen and Co.
(3) Sheriff's Single Entry shown by Double Entry. Allen and Co.

Charts—

(1) Johnston's General Knowledge Charts. Nos. 1, 2, 3, 4. W. and A. K. Johnston.

Christmas Cards—

(1) Hildesheimer and Faulkner.

Classics—

(1) White's Grammar School Texts. Virgil's Æneid. Book XI. Longmans and Co.
(2) White's Grammar School Texts. Xenophon. Book VIII. Longmans and Co.

Electricity—

(1) Ferguson's Electricity. W. and R. Chambers.

Euclid—

(1) Casey's First Six Books. Longmans and Co.

Geography—

(1) Blackie's Geographical Reader. No. 6. Blackie.
(2) The Children's World. Part 1. A. Johnston.

History—

(1) Simple Outline of English History. Cassell, Petter, and Galpin.

Maps—

(1) Marcus Ward's Series of Halfpenny Maps. Marcus Ward and Co.

New Code—

(1) The New Code, with Explanatory Notes by T. E. Heller. Bemrose and Sons.

Miscellaneous—

(1) Watts' History of a Lump of Coal. A. Johnston.
(2) Paull's 'Friar Hildebrand's Cross.' Hodder and Stoughton.
(3) Clifford's 'What H. M. Inspectors Say.' North of England Scholastic Trading Co., Darlington.
(4) The Children's Daily Help for the Christian Year. Griffith and Farran.
(5) Macaulay's Essay on Lord Clive. W. and R. Chambers.

Periodical Literature—

(1) Cambridge Examiner. Vol. 2. No. 7. Stanford.
(2) Universal Instructor. Part 24. Ward, Lock, and Co.
(3) Sports and Pastimes. Part 7. Cassell, Petter, and Galpin.
(4) School Examiner. Gage and Co., Toronto.

Poetry—

(1) Shakspere's 'Romeo and Juliet,' 'Hamlet,' Much Ado about Nothing,' 'The Tempest,' 'The Merchant of Venice,' 'A Midsummer Night's Dream,' 'Macbeth.' Smith, Elder, and Co.
(2) Shakspere's 'King Henry V.' W. and R. Chambers.
(3) Chaucer: 'The Squiere's Tale.' W. and R. Chambers.

Readers—

(1) The Rev. J. G. Wood's Natural History Readers. Standards 1, 2, 3. Isbister.
(2) Chambers' Historical Readers. Part 3. W. and R. Chambers.

Teaching—

(1) Fitch's Lectures on Teaching. Cambridge University Press Warehouse.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month,* or they cannot be attended to in the ollowing issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'*The Query Editor,*'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. INQUISITIVE.—(*a*) A beats B by 10 yards in 100 yards race, and B beats C by 10 yards in 100 yards race. Required by how many yards A will beat C in 1000 yards race.

(*b*) Also if A starts at the rate of $3\frac{1}{2}$ miles an hour, and B follows him 4 hours after at the rate of 4 miles an hour, how many miles has A travelled before B overtakes him?

(*Edinburgh University Local Examination,* 1882.)

(*a*) A runs 100 yards while B runs 90 yards,
B ,, ,, ,, C ,, ,,
∴ A runs 100 yards while C runs $\frac{90\times 90}{100}$ yards
$=81$ yards;
∴ A will beat C by $(100-81)$ yards × 10 or 190 yards in 1000 yards race. Ans.

(*b*) Distance gone by A in 4 hours $=(3\frac{1}{2}\times 4)$ miles
$=14$ miles;
,, gained by B in an hour $=\frac{1}{4}$ mile;
∴ Time to gain 14 miles $=28$ hours;
∴ Distance gone $=(28\times 4)$ miles
$=112$ miles. Ans.

2. PLUTO.—Two persons start from London and Brighton (50 miles apart) at the same time; the first goes $4\frac{1}{2}$ miles an hour, and rests 20 minutes at the end of every 10 miles; the other walks steadily $3\frac{1}{2}$ miles an hour. Where will they meet?

They would meet $\left(50\times\frac{4\frac{1}{2}}{4\frac{1}{2}\times 3\frac{1}{2}}\right)$ miles or $28\frac{4}{7}$ miles from London, if the first person did not rest;

But he rests 40 minutes, and therefore is $\frac{2}{3}$ of $4\frac{1}{2}$ miles or 3 miles from this place;

Part of this distance gone by second person when they meet
$=3\times\left(\frac{3\frac{1}{2}}{4\frac{1}{2}+3\frac{1}{2}}\right)$ miles $=1\frac{5}{7}$ miles;

∴ They will meet $(28\frac{4}{7}-1\frac{5}{7})$ miles or $26\frac{6}{7}$ miles from London. Ans.

3. CRACKUS.—A walks to a place at the rate of $4\frac{1}{2}$ miles per hour. At 8 miles from his destination he meets B, and turns back with him (walking at B's rate) for a mile. If A is half an hour late at his destination, what is B's rate of walking, and at what rate should A have walked, after leaving B, so as to arrive at the proper time?

It takes A $\frac{1}{4}$ hour to walk 1 mile at his rate, and 1 mile at B's rate;
A can walk 1 mile in $\frac{2}{9}$ hour.
∴ B ,, ,, $(\frac{1}{2}-\frac{2}{9})$ hour $=\frac{5}{18}$ hour;
∴ B's rate per hour $=\frac{18}{5}$ miles $=3\frac{3}{5}$ miles. Ans.

To walk 8 miles it takes A $\frac{8}{4\frac{1}{2}}$ hours $=1\frac{7}{9}$ hours;

∴ To arrive at the proper time A must walk 9 miles in $(1\frac{7}{9}-\frac{5}{18})$ hours $=1\frac{1}{2}$ hours;
∴ He must walk at the rate of 6 miles per hour. Ans.

4. ALONSO.—How many lbs. of tea worth 2s. 6d. per lb. and 3s. per lb., respectively, must be mixed together so that the mixture may be worth 2s. 8d. per lb.?

Gain on first kind $=2$s. 8d. $-$ 2s. 6d. $=2$d.
Loss on second kind $=3$s. $-$ 2s. 8d. $=4$d.
∴ Quantity at 2s. 6d. : Quantity at 3s. :: 4 : 2
:: 2 : 1. Ans.

5. IVANHOE, Ashby, Z.—In what proportions must tea at 3s. and 3s. 6d. a lb. be mixed, in order to sell at 3s. 8d. a lb. and gain 10 per cent.?

Cost price of mixture $=3$s. 8d. $\times\frac{100}{110}$
$=3$s. 4d.
Gain on first kind at this price $=3$s. 4d. $-$ 3s. $=4$d.
Loss ,, second ,, ,, $=3$s. 6d. $-$ 3s. 4d. $=2$d.
∴ Quantity at 3s. : Quantity at 3s. 6d. :: 2 : 4
:: 1 : 2. Ans.

6. J. C.—A farmer said if he had as many more horses, $\frac{1}{3}$ as many more, and $\frac{1}{5}$ as many more, he would have 25. How many had he?

He would have $(1+1+\frac{1}{3}+\frac{1}{5})$ or $2\frac{1}{3}$ times as many as at first;
∴ No. he had $=(25\div 2\frac{1}{3})$ horses
$=10$ horses. Ans.

7. YELSERP.—A ship 40 miles from the shore springs a leak which admits $3\frac{3}{4}$ tons of water in 12 minutes. 60 tons would suffice to sink her, but the ship's pumps can throw out 12 tons of water in an hour. Find the average rate of sailing so that she may reach the shore just as she begins to sink. (*Barnard Smith.*)

Quantity admitted per hour $=(3\frac{3}{4}\times 5)$ tons
$=18\frac{3}{4}$ tons;
,, left after pumping $=6\frac{3}{4}$ tons;
∴ Time to sink the vessel $=(60\div 6\frac{3}{4})$ hours
$=\frac{240}{27}$ hours
$=\frac{80}{9}$ hours;

∴ Average rate of sailing per hour $= (40 \div \frac{80}{9})$ miles
$= \frac{9}{2}$ miles
$= 4\frac{1}{2}$ miles. Ans.

8. EFFIGY.—A passenger train 218 ft. long travelling at the rate of 30 miles per hour overtakes a goods train 453 ft. long travelling at the rate of $22\frac{1}{2}$ miles per hour; how long will the passenger train be in clearing the goods train?

Sum of lengths of trains $= (218 + 453)$ ft. $= 671$ ft.
Difference of rates " $= (30 - 22\frac{1}{2})$ mls. $= 7\frac{1}{2}$ mls.

∴ Time required $= \frac{671 \text{ ft.}}{7\frac{1}{2} \text{ mls.}}$ of an hour

$= \frac{671 \times 1 \times 60}{15 \times 1760 \times 3}$ min.

$= 1$ min. Ans.

Note.—Find the *sum* of the rates of the trains when going in *opposite* directions, and the *difference* when going in *same* direction.

9. WAMBA.—If a piece of work can be finished in 45 days by 35 men, and if the men drop off by 7 at a time at the end of every 15 days, how long will it be before the work is finished? (*Barnard Smith.*)

Part done by 7 men in 15 days $= \left(\frac{1}{5} \text{ of } \frac{7}{35}\right)$ of the work
$= \frac{1}{25}$ of the work;
Part done in first 15 days $= \frac{1}{3}$ of the work,
∴ Part remaining $= \frac{2}{3}$ of the work;
Part done in second 15 days $= (\frac{1}{3} - \frac{1}{25})$ of the work
$= \frac{8}{25}$ of the work,
∴ Part remaining $= (\frac{2}{3} - \frac{8}{25})$ of the work
$= \frac{2}{5}$ of the work;
Part done in third 15 days $= (\frac{2}{5} - \frac{1}{25})$ of the work
$= \frac{1}{3}$ of the work,
∴ Part remaining $= (\frac{2}{5} - \frac{1}{3})$ of the work
$= \frac{1}{5}$ of the work;
Part done in fourth 15 days $= (\frac{1}{5} - \frac{1}{25})$ of the work
$= \frac{4}{25}$ of the work,
∴ Part remaining $= (\frac{1}{5} - \frac{4}{25})$ of the work
$= \frac{1}{25}$ of the work;
Part done in fifth 15 days $= (\frac{1}{5} - \frac{1}{25})$ of the work
$= \frac{1}{25}$ of the work.
∴ Time required to complete the work $= (15 \times 5)$ days
$= 75$ days. Ans.

10. SNOWDROP.—If 3 men earn as much as 5 women a day, and 12 men together with 6 women earn £10 8s. in 4 days, what number of women must work along with 10 men that together they may earn £19 13s. 4d. in 10 days?

3 men earn as much as 5 women,
∴ 12 " " " 20 "
12 men & 6 wom. " " 26 "
10 " " " $\frac{5 \times 10}{3}$ " $= 16\frac{2}{3}$ women.

Amount earned in a day in first case $= £10\ 8s. \div 4 = £2\ 12s.$
" " " second case $= £19\ 13s.\ 4d. \div 10$
$= £1\ 19s.\ 4d.$

£ s. £ s. d. women.
∴ 2 12 : 1 19 4 :: 15 : No. of women in second case.
20 20
52 39
3 3
156 117
9 59
3 $= 19\frac{3}{4}$ women.

∴ No. of women required with 10 men $= (19\frac{3}{4} - 16\frac{2}{3})$ women.
$= 3$ women. Ans.

11. NIP.—What is the least number of years for which simple interest must be reckoned at 4 per cent. on £145 7s. 6d., so that the interest may be an exact number of pounds sterling?

Interest for a year $= \frac{1}{25}$ of £145 7s. 6d.
$= \frac{1}{25}$ of $£145\frac{3}{8}$
$= £5\frac{1}{200}$;
∴ No. of years $= 200$. Ans.

12. VLADIMIR.—I sell out of the 3 per cents. at 96, and invest in 5 per cent. stock at par; find how much per cent. my income is increased.

Income per cent. in first case $= \left(3 \times \frac{25}{96}\right)£$
$= £3\ 2s.\ 6d.$
∴ Increase per cent. $= £5 - £3\ 2s.\ 6d.$
$= £1\ 17s.\ 6d.$ Ans.

13. JULIUS.—Assuming that the value of 2 Suacan scudi is greater than 10½d. and less than 11d., and the value of an Austrian swanziger is greater than 8d. and less than 8½d., prove that the value of 544 Suacan scudi differs from 355 Austrian swanziger by less than that of 19 Austrian swanziger.
(*Johnson's* 'Civil Service Arithmetic.')

Value of 544 Suacan scudi is greater than (10½d. × 272) or £11 18s., and less than (11d. × 272) or £12 9s. 4d.;
Value of 355 Austrian swanziger is greater than (8d. × 355) or £11 16s. 8d., and less than (8½d. × 355) or £12 11s. 5½d.;
Value of 19 Austrian swanziger is greater than (8d. × 19) or 12s. 8d., and less than 13s. 5½d.
Difference between 544 scudi and 355 swanziger is less than £12 9s. 4d. − £11 16s. 8d., or 12s. 8d.
∴ Difference is less than the value of 19 swanziger.

14. NEPHESH.—The hour and minute hands of my watch are exactly together, and it is between 5 and 6 o'clock. What is the time?

The minute hand moves twelve times as fast as the hour hand;
∴ Difference between the rates of the minute and hour hands is eleven times the rate of the hour hand.
The minute hand must gain twenty-five minutes on the hour hand to be exactly together;
∴ Distance gone by hour hand $= 25$ min. $\div 11 = 2\frac{3}{11}$ min.
∴ Time when the hands are together is $27\frac{3}{11}$ mins. past 5.

Note.—Refer to No. 5 of the Arithmetical Queries in our issue for September.

15. G. F. J.—I sold a book to a friend 17 per cent. below cost price; if I had taken his offer of an additional 5s., I should have gained 7 per cent. on my outlay. What did the book cost me, and what did I get for it?

£17 + £7 = £24;
£ s. £
∴ 17 : 5 :: 168 : cost price
6 25
$= 1\frac{18}{21}$s.
$= £1\ 0s.\ 10d.$ Ans.

£ £ s. d. £
∴ 168 : 1 0 10 :: 83 : selling price.
2 20 5
20 2 | 415
12 12 | 207½
168 17s. 3½d.
5
$= 17s.\ 3\frac{1}{2}d.$ Ans.

16. TRURON.—Arrange $\cdot 7\frac{1}{13}$, $\sqrt{1\ 81}$, and 1·346 in order of magnitude, and find to five places of decimals by how much the sum of the largest and smallest of these numbers differs from twice the other number.

$$\cdot 742 \overline{)1\cdot000(}1\cdot347708$$
742
2580
2226
3540
2968
5720
5194
5260
5194
6600
5936
664

$$
\begin{array}{r|l}
1\cdot81 & 1\cdot345362\ldots \\
1 & \\
\hline
23 & 81 \\
 & 69 \\
\hline
264 & 1200 \\
 & 1056 \\
\hline
2685 & 14400 \\
 & 13425 \\
\hline
26903 & 97500 \\
 & 80709 \\
\hline
269056 & 1679100 \\
 & 1614396 \\
\hline
2690722 & 6470400 \\
 & 5381444 \\
\hline
 & 1088956
\end{array}
$$

$\therefore$ In order of magnitude:—$\frac{7}{11}$, 1·346, $\sqrt{1\cdot81}$. Ans.

$$
\begin{aligned}
1\cdot347708 + 1\cdot346 &= 2\cdot693708 \\
1\cdot345362 \times 2 &= 2\cdot690724 \\
&\quad\ \cdot002984 \\
&= \cdot00298\ldots \text{ Ans.}
\end{aligned}
$$

17. O. H. F.—Three pipes, A, B, and C, in connection with a cistern are opened respectively at 1, 2, and 3 o'clock. A alone can fill it in 3 hours, and B alone in 4 hours, while C can empty it in an hour; at what time will the cistern be empty?

A can fill the cistern in 3 hours,
B ,, ,, 4 ,,
C ,, empty ,, 1 hour;
$\therefore$ A ,, fill in 1 hour $\frac{1}{3}$ of the cistern,
B ,, ,, $\frac{1}{4}$,,

$$
\begin{aligned}
\text{Part filled when C is opened} &= \tfrac{1}{3}\times 2 + \tfrac{1}{4} \\
&= \tfrac{8}{12} + \tfrac{1}{4} \\
&= 1\tfrac{1}{12};
\end{aligned}
$$

$$
\begin{aligned}
\text{Part emptied in 1 hour when all are open} &= 1 - (\tfrac{1}{3} + \tfrac{1}{4}) \\
&= 1 - \tfrac{7}{12} \\
&= \tfrac{5}{12};
\end{aligned}
$$

$$
\begin{aligned}
\therefore \text{Time to empty the cistern} &= (1\tfrac{1}{12} \div \tfrac{5}{12}) \text{ hours} \\
&= \tfrac{13}{6} \text{ hours} \\
&= 2\tfrac{1}{6} \text{ hours} \\
&= \tfrac{1}{6} \text{ hour past 5} \\
&= \underline{12 \text{ mins. past 5}}. \text{ Ans.}
\end{aligned}
$$

18. OPTO CNAWAN.—A boatman rowing against the tide passes a body floating with the tide, and in 9 minutes afterwards is a mile distant from it; in 35 minutes more he rows $2\frac{1}{2}$ miles, and then returns. At what rate per hour does he return, supposing the tide to flow uniformly in one direction? (*Colenso.*)

He rows $2\frac{1}{2}$ miles in 35 minutes,
,, 1 mile ,, $\frac{35}{2\frac{1}{2}}$,,
$= 14$,,
$\therefore$ In 9 min. he rows $\frac{9}{14}$ of a mile,
$\therefore$ Rate of tide $= \frac{5}{14}$ of a mile in 9 min.

$$
= \left(\frac{5}{14} \times \frac{60}{9}\right) \text{ miles per hour}
$$

$$
= 2\tfrac{5}{21} \text{ miles per hour};
$$

His rate against the tide $= \frac{9}{14}$ miles per hour.
$= 4\frac{2}{7}$,,
,, without ,, $= (4\frac{2}{7} + 2\frac{5}{21})$,,
$= 6\frac{3}{7}$,,
$\therefore$,, with ,, $= (6\frac{3}{7} + 2\frac{5}{21})$,,
$= \underline{9\frac{1}{21} \text{ miles per hour}}$. Ans.

Algebra.

1. ROBINSON CRUSOE.—Divide $b(x^3+a^3)+ax(x^2-a^2)+a^3(x+a)$ by $(a+b)(x+a)$.

$$
\begin{aligned}
& b(x^3+a^3)+ax(x^2-a^2)+a^3(x+a) \\
&= bx^3+a^3b+ax^3-a^3x+a^3x+a^4 \\
&= ax^3+bx^3+a^4+a^3b \\
&= x^3(a+b)+a^3(a+b) \\
&= (a+b)(x^3+a^3). \\
& (a+b)(x^3+a^3) \div (a+b)(x+a) \\
&= (x^3+a^3) \div (x+a) \\
&= \underline{x^2-ax+a^2}. \text{ Ans.}
\end{aligned}
$$

2. FOLKESTONIAN.—Divide $(x+1)^8+4(x+1)^6+6(x+1)^4+4(x+1)^2+1$ by x^2+2x+2.

(*Certificate Examination.*)

$$
\begin{aligned}
& (x+1)^8+4(x+1)^6+6(x+1)^4+4(x+1)^2+1 \\
&= \{(x+1)^2+1\}^4 \\
&= \{x^2+2x+1+1\}^4 \\
&= \{x^2+2x+2\}^4 \\
& (x^2+2x+2)^4 \div (x^2+2x+2) \\
&= (x^2+2x+2)^3 \\
&= \underline{x^6+6x^5+18x^4+32x^3+36x^2+24x+8}. \text{ Ans.}
\end{aligned}
$$

3. F. S.—Solve:—

$$
\frac{a}{x+a} + \frac{b}{x+b} = \frac{a-c}{x+a-c} + \frac{b+c}{x+b+c}.
$$

(Cambridge Local, Junior Algebra Paper, 1879.)

$$
\begin{aligned}
\frac{a}{x+a} + \frac{b}{x+b} &= \frac{a-c}{x+a-c} + \frac{b+c}{x+b+c} \\
\frac{a}{x+a} - \frac{a-c}{x+a-c} &= \frac{b+c}{x+b+c} - \frac{b}{x+b} \\
\frac{ax+a^2-ac-ax+cx-a^2+ac}{(x+a)(x+a-c)} &= \frac{bx+cx+b^2+bc-bx-b^2-bc}{(x+b)(x+b+c)} \\
\frac{cx}{(x+a)(x+a-c)} &= \frac{cx}{(x+b)(x+b+c)} \\
\frac{1}{(x+a)(x+a-c)} &= \frac{1}{(x+b)(x+b+c)} \\
(x+a)(x+a-c) &= (x+b)(x+b+c) \\
(x+a)^2-c(x+a) &= (x+b)^2+c(x+b) \\
x^2+2ax+a^2-cx-ac &= x^2+2bx+b^2+cx+bc \\
2ax-2bx-2cx &= b^2+bc+ac-a^2 \\
2(a-b-c)x &= -(a^2-ac-bc-b^2) \\
2x &= -(a+b) \\
\therefore x &= \underline{-\frac{a+b}{2}}
\end{aligned}
$$

As we divided both sides of the equation by cx, we obtain a value of x by putting $cx=0$;

$$
\therefore x = 0 \text{ or } \underline{-\frac{a+b}{2}}. \text{ Ans.}
$$

4. VORTIGERN.—A and B make a joint-stock of £500, by which they gained £160, of which A had for his share £32 more than B. What did each contribute to the stock? (To be solved (1) by the aid of only one letter, and (2) by the aid of two letters.)

(1) Let x = amount contributed by A in pounds,
Then $500-x$ = ,, ,, B ,, ;
B received for his share $\frac{1}{2}$ (£160 − £32) = £64,
And A ,, ,, £64 + £32 = £96;

$$
\begin{aligned}
\therefore \frac{x}{500-x} &= \frac{96}{64} \\
\frac{x}{500-x} &= \frac{3}{2} \\
2x &= 3(500-x) \\
&= 1500-3x \\
2x+3x &= 1500 \\
5x &= 1500 \\
\therefore x &= \underline{300}.
\end{aligned}
$$

$\therefore$ A contributed £300 and B £200. Ans.

(2) Let x = amount contributed by A in pounds,
And y = ,, ,, B ,, ;

$$
\therefore \left.\begin{array}{ll} (1)\ x+y=500 \\ (2)\ \dfrac{x}{y} = \dfrac{96}{64} \end{array}\right\}
$$

$$
\begin{aligned}
(2)\ \frac{x}{y} &= \frac{96}{64} \\
&= \frac{3}{2} \\
2x &= 3y \\
\therefore y &= \underline{\frac{2x}{3}}.
\end{aligned}
$$

$$
\begin{aligned}
(1)\ x+y &= 500 \\
x+\frac{2x}{3} &= 500 \\
\frac{5x}{3} &= 500 \\
5x &= 1500
\end{aligned}
$$

$\therefore$ $\underline{x=300, \text{ and } y=200}$. Ans.

5. NERO, Pontypridd.—x^4+rx+s has a divisor of the form $(x+a)^2$, if $\left(\frac{s}{3}\right)^3=\left(\frac{r}{4}\right)^4$. Prove this.

$$x^2+2ax+a^2)x^4+\ rx\ +s(x^2\ -2ax+3a^2$$
$$x^4+2ax^3+a^2x^2$$
$$-2ax^3-a^2x^2\ +rx+s$$
$$-2ax^3-4a^2x^2-2a^3x$$
$$3a^2x^2+(2a^3+r)x+s$$
$$3a^2x^2+6a^3x+3a^4$$

$\therefore x^4+rx+s$ has a divisor of the form $(x+a)^2$, if $2a^3+r=6a^3$, and $3=3a^4$.

$$2a^3+r=6a^3 \qquad\qquad s=3a^4$$
$$\therefore r=4a^3 \qquad\qquad \frac{s}{3}=a^4$$
$$\frac{r}{4}=a^3 \qquad\qquad \left(\frac{s}{3}\right)^3=a^{12}$$
$$\left(\frac{r}{4}\right)^4=a^{12}$$

$\therefore$ It is divisible if $\left(\frac{s}{3}\right)^3=\left(\frac{r}{4}\right)^4$. Ans.

6. AUGUSTINE.—Divide 46 into two parts, such that if one part be divided by 7, and the other part by 3, the sum of the quotients shall be 10. (*Todhunter.*)

Let x = one part,
then $46-x$ = other part
$$\therefore \frac{x}{7}+\frac{46-x}{3}=10$$
$$3x+322-7x=210$$
$$3x-7x=210-322$$
$$-4x=-112$$
$$\therefore x=28.$$

$\therefore$ Parts are 28 and 18. Ans.

7. READER.—In a race of ten miles between a horseman and a man on foot, the man on foot has 5 minutes start. A part of the race was by the side of a railway where the man on foot meets a train going in the opposite direction. He passed it in $31\frac{1}{7}$ seconds. In exactly one minute afterwards the horseman passed the train in 3 seconds. The man on foot won the race by $27\frac{3}{11}$ seconds. Supposing the train to be $76\frac{4}{5}$ yards long, at what rate of speed per hour did the man on foot, the horseman, and the train run, respectively, and where did the man on foot, and the horseman meet the train?

Rates of train and horseman in miles per hour—

$$=76\tfrac{4}{5}\times 20\times 60\div 1760$$
$$=\frac{\cancel{77}\times\cancel{80}}{\cancel{1760}}$$
$$=52;$$

Rates of train and man on foot in miles per hour—

$$=76\tfrac{4}{5}\times 60\times 60\div(31\tfrac{1}{7}\times 1760)$$
$$=\frac{\cancel{77}\times\cancel{80}\times\cancel{60}\times 17}{\cancel{62}\times\cancel{1760}}$$
$$=51.$$

Gain by horseman in 10 miles—

$$=5 \text{ min.}-27\tfrac{3}{11} \text{ secs.}$$
$$=(5-\tfrac{5}{11}) \text{ min.}$$
$$=4\tfrac{6}{11} \text{ min.}$$
$$=\tfrac{5}{66} \text{ hr.}$$

Let x = rate of man on foot in miles per hour,
Then $x+1$ = " horseman " " ;

$$\therefore \frac{10}{x}-\frac{10}{x+1}=\tfrac{5}{66}$$
$$\frac{2}{x}-\frac{2}{x+1}=\tfrac{1}{66}$$
$$2x+2-2x=\tfrac{1}{66}(x^2+x)$$
$$x^2+x=132$$
$$x^2+x+(\tfrac{1}{2})^2=132+\tfrac{1}{4}$$
$$=\tfrac{529}{4}$$
$$x+\tfrac{1}{2}=\tfrac{23}{2}$$
$$\therefore x=11.$$

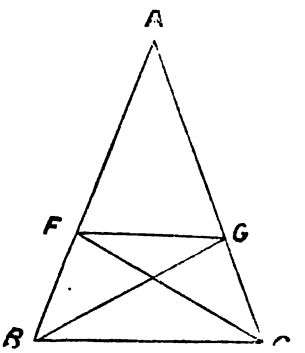
$\therefore$ Rate of man on foot per hour = 11 miles,
" horseman " = 12 "
" train " = (51 − 11) miles
= 40 miles.

In one minute train goes $\frac{4}{5}\frac{0}{0}$ or $\frac{2}{3}$ of a mile,
" " horseman " $\frac{1}{1}\frac{2}{8}$ or $\frac{1}{9}$ "
$\therefore$ When man on foot meets train, horseman is $(\frac{2}{3}+\frac{1}{9})$ or $\frac{7}{9}$ of a mile behind him;
$\therefore$ Horseman has gained $(\frac{1}{6}\frac{1}{0}\times 5-\frac{1}{1}\frac{2}{8})$ of a mile
$=(\frac{1}{1}\frac{1}{2}-\frac{1}{1}\frac{2}{8})$ of a mile
$=\frac{1}{3}\frac{1}{6}$ of a mile;
Horseman gains 1 mile in an hour,
$\therefore$ " " $\frac{1}{3}\frac{1}{6}$ " 3 min.;
$\therefore$ Distance gone by man on foot when he meets train
$=\{\frac{1}{1}\frac{1}{2}\times(3+5)\}$ miles
$=\frac{8}{9}\frac{8}{9}$ miles
$=1\frac{7}{9}$ miles. Ans.

$\therefore$ Distance gone by horseman when he meets train
$=(\frac{7}{9}\frac{7}{2}\times 4)$ of a mile
$=\frac{7}{9}$ of a mile. Ans.

Geometry.

1. GARFIELD.—Prove the fifth proposition (Book I.) without producing the sides.



Take F in AB, and make AG = AF. Join FC, GB, FG.

Proof.—The two sides FA, AC = the two sides GA, AB, each to each,
and the angle FAG is common to the two triangles AFC AGB;
$\therefore$ the base FC = the base GB,
and the angle ACF = the angle ABG. (I. 4.)

In the triangles FBG, GCF, the two sides FB, BG = the two sides GC, CF, each to each,
and the angle FBG = the angle GCF,
$\therefore$ the two triangles are equal; (I. 4.)
the angle BFG = the angle CGF,
and the angle FGB = the angle GFC;
$\therefore$ the angle BFC = the angle CGB. (Ax. 3.)

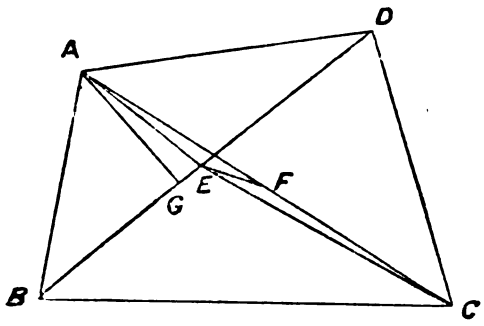
In the triangles BFC, CGB, the two sides BF, FC = the two sides CG, GB, each to each,
and the angle BFC = the angle CGB,
$\therefore$ the two triangles are equal, and the angle FBC = the angle GCB. (I. 4.) Q. E. D.

Note.—(1) None issued that we know of. (2) Mansford's, 1s. 6d. (Hughes); Wollman's, 1s. (Jarrold's). (3) Writing pretty fair.

DANEBURGH.—The squares on the sides of a quadrilateral are together greater than the squares on its diagonals by four times the square on the straight line joining the middle points of its diagonals.—(*Todhunter*).

Let the diagonals BD, AC of the parallelogram ABCD be bisected in E, F.

Draw AG perpendicular to BD, and join AE, CE, EF.



Proof.—$AB^2 = BE^2 + AE^2 - 2BE.EG$, (II. 13.)
$AD^2 = DE^2 + AE^2 + 2DE.EG$; (II. 12.)
$\therefore AB^2 + AD^2 = 2BE^2 + 2AE^2$; (Ax. 2.)

Similarly, $BC^2 + CD^2 = 2BE^2 + 2CE^2$;

$\therefore$ Squares on the sides of the quadrilateral $= 4BE^2 + 2AE^2 + 2CE^2$.

Again, $AE^2 + CE^2 = 2AF^2 + 2EF^2$, and the doubles of these are equal;

$\therefore$ Squares on the sides of the quadrilateral $= 4BE^2 + 4AF^2 + 4EF^2 = BD^2 + AC^2 + 4EF^2$.

$\therefore$ Squares on the sides are together greater than the squares on the diagonals by four times the square on EF. Q. E. D.

Mensuration.

1. NORMAN.—A conical wine-glass 2 inches broad and $2\frac{1}{2}$ inches deep is half filled with water. Find the depth and quantity of water.

$$\text{Content of glass} = \frac{1^2 \times 3{\cdot}14159 \times 2\frac{1}{2}}{3} \text{ cub. in.}$$
$$= \frac{3{\cdot}14159 \times 5}{6} \text{ cub. in.}$$
$$\therefore \text{ Quantity of water in glass} = \frac{15{\cdot}70795}{12} \text{ cub. in.}$$
$$= 1{\cdot}308\,09\ldots \text{cub. in.} \quad \text{Ans.}$$

Let H be the depth of the glass, h the depth of the water, a the area of top of glass, and b the area of surface of water. Then,

$$a : b :: H^2 : h^2.$$
$$\text{Content of glass} = \tfrac{1}{3}aH,$$
$$\text{,, water} = \tfrac{1}{3}bh.$$
$$\therefore \tfrac{1}{3}bh = \tfrac{1}{3}aH$$
$$2bh = aH$$
$$\therefore b = \frac{aH}{2h}.$$
$$\therefore a : \frac{aH}{2h} :: H^2 : h^2$$
$$2h : H :: H^2 : h^2$$
$$\therefore 2h^3 = H^3$$
$$= (\tfrac{1}{2} \text{ in.})^3$$
$$= \tfrac{1}{8} \text{ cub. in.}$$
$$h^3 = \tfrac{1}{16} \text{ cub. in.}$$
$$\therefore h = \sqrt[3]{7{\cdot}8125} \text{ cub. in.}$$
$$= 1{\cdot}98425\ldots \text{in.}$$

$\therefore$ Depth of water in glass $= 1{\cdot}98425\ldots$ in. Ans.

General.

1. E. JONES.—The book you require is *Johnston's* 'English Composition and Essay Writing,' price 3s. 6d. (Longmans).

2. C. OLLYS.—*Murray's* 'Grammar,' 3s. 6d. (Allman: by *Ellis*, 1s. (Dean): 2d., cloth 4d. (Hardwicke): by *E. D. Jackson*, 6d. (Heywood): 32mo. 6d., 12mo. 3s., closer lines, 2s., (Mozley): 'Exercises,' 2s., closer lines 1s., Key, 2s., (Mozley): 'Grammar,' 3s., (Tegg). There are also several abridgments.

3. ORKNEY.—The Agent-general for New South Wales is The Hon. Saul Samuel, C.M.G., 5, Westminster Chambers, S.W.

4. INCOGNITO.—To give a full account of the Egyptian Debt would occupy much more space than we can spare and would not be of much interest to our readers. We must refer you, therefore, to any of the standard works on Egypt. 'The Encyclopædia Britannica' devotes some pages to the subject.

5. ENQUIRER.—We do not know the book you mention. There is one called *Beeton's* 'Public Speaker,' published by Ward, Lock and Co., price 3s. 6d.

6. SILVIUS.—*Barnard Smith's* 'Arithmetic' 4s. 6d. (Macmillan). *Mansford's*, 1s. 6d. (Hughes). *Hamblin Smith's* 3s. 6d. (Rivingtons).

7. M. WELLS.—The preposition *to* is not an essential part of the infinitive mood, nor an invariable sign of it. Many verbs (as *may, can, shall, will, must, let, dare, do, bid, make, see, hear, feel, need*) are followed by the simple infinitive without *to* (*Mason's* 'Grammar,' paragraph 195).

8. J. KIRKE.—Iceland is supposed to have been inhabited by a small colony of Irish Culdees long prior to its historic discovery about the year 860, and for about sixty years after that date, a tide of immigration set in towards it from Norway, the Western Isles (Hebrides), and from Ireland.

9. FRED.—The interval from F sharp to the C next above is an *Imperfect fifth*, comprising two tones and two semitones. This interval is also called the Diminished 5th, the False 5th, and the Flat 5th. The Perfect 5th would be from F upwards to C (both natural), or from C to G. Making the G sharp, the interval would become an Augmented 5th: this latter is a Chromatic interval; the two former 5ths are Diatonic.

10. MIDLOTHIAN SUBSCRIBER.—Your answer is correct.

11. A READER.—You will find the solution of your deduction in our issue for May.

12. PESTACHIO.—On looking at a globe or map it will be noticed that all the great and continuous tracts of land become pointed as they stretch towards the south, by which they are made to assume a pyramidal or triangular form at the extremity. The continents of North and South America and of Africa are the most remarkable illustrations of this fact.

In reference to the continents of Europe and Asia, there is also the general tendency to taper towards the south; in the former continent, however, this tendency is greatly obstructed by the vicinity of the African continent, so that Spain and Portugal do not so manifestly assume the triangular form. Still this tendency is partially developed in various parts of the south of this continent; as in the conformation of Italy and Greece, which taper, but very irregularly, towards the south, evidently in consequence of the feebler action of the Mediterannean Sea, as compared with the full play of the great Atlantic and Pacific Oceans. In the latter continent, the tendency to taper towards the south has been divided in such a manner as to present the three peninsulas of Arabia, India, and Malacca.

The small peninsula of Jutland is an exception to the general rule, as it points northward.

13. BARDD COCOS.—*Todhunter's* 'Algebra for Colleges and Schools,' 7s. 6d.

14. DELTA.—Your solution is incorrect, as you have taken the walk *outside* the garden, instead of taking it part of the garden. How could the walk take up half the ground, if it was outside the garden?

15. B. W. R.—It should be proved that AD falls nearer to AB than AE, but there is a much simpler solution than the one you have forwarded. In your method of proof by drawing AG perpendicular to BC, you assume that G falls between B and D.

16. PRECEPTOR.—The time at which Arabic numerals were introduced into Europe is not definitely known, but it is supposed that the knowledge of them was brought to Spain early in the 11th century by the Arabs, and from thence transmitted throughout the rest of the Continent. Their introduction into England was very gradual, for in the writings and inscriptions of

the Middle Ages they are constantly found mixed up with Roman numerals (thus xxx2 for 32, x4 for 14), and it was not until the commencement of the 16th century that their use became really general.

17. KRODON.—*Addison's* 'Papers on the Imagination,' 3d. (W. and R. Chambers). We do not know of any annotated edition of *Swift's* 'Battle of the Books.' His whole works can be obtained in the Bohn Series, and also, we believe, from Messrs. Chatto and Windus.

18. WAMBA.—A thorough knowledge of Parts I. and II. will be sufficient, but, of course, if you have time it would not be labour lost to try the more advanced sections of Part IV.

19. ENTRE-NOUS.—In the sentence 'He is as strong as you, although he looks like death,' *as* is an adverb qualifying *strong; strong*, an adjective qual. *He: as*, a conjunction connecting 'He is as strong' to 'you (are strong);' *although*, a subordinative conjunctive, connecting 'he looks like death' to the preceding sentence; *like*, adj. qual. *he; death* is governed by the prep. 'to' understood.

In the sentence 'Tom also says so,' *also* is an adverb qualifying *says*. *So* is a pronoun, object. case governed by *says*, and equivalent to *the same thing*. Many people would, however, class this last word as an adverb.

20. MAESTRO.—The expression 'She looks nice' is quite correct, and, unlike many colloquialisms, can be defended on grammatical grounds. The verb *looks* is one of incomplete predication, and as it is intransitive, the complement of the predicate stands in the predicative relation to the subject; that is, to apply the case to the sentence in question, the word *nice* is predicated or asserted of the subject *she*, and not of the verb *looks*, and consequently the adjective *nice* is used, and not the adverb *nicely*. (See *Mason's* 'Gram.,' paragraph 393.)

21. AP MERLIN.—Get *Johnston's* 'Guide to the Civil Service,' price 3s. 6d. (Longmans). Candidates, of course, do not take in *all* the subjects specified in your list, but only the obligatory ones and such of the voluntary as they deem themselves proficient in. It is of no use, whatever, 'taking up' subjects of which you have but a smattering. The marks obtained for a subject do not count at all unless they rise above a certain per centage of full marks. We shall be happy to advise you on the books required, when you have selected your subjects. The papers in *Cassell's* 'Popular Educator' are excellent.

22. ARABI.—The easiest and quickest way is by the Protractor, as equal arcs subtend equal angles at the centre.

23. PWLLHELI.—From St. John ix.

A (*a*) And His disciples asked Him, saying,

(Principal Sentence.)

And.....Connective
His disciples .....Subject
asked ....Predicate
him .....Object (indirect)
saying ....Enlargement of subject

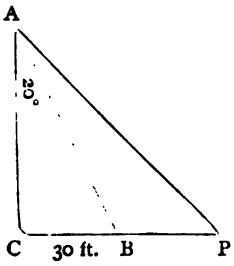
(*b*) Which is by interpretation, Sent.

(Adjective Sentence.)

Which.....Subject
is Sent.....Predicate
by interpretation ... (=being interpreted) Attribute of subject.

B (*a*) That he was born blind. (Adverbial Sentence.)
(*b*) Go, wash in the pool of Siloam. (Noun Sentences:)
(*c*) A man made clay. (Noun Sentence.)
(*d*) Go to the pool of Siloam. (Noun Sentence.)

24. COOPE.—ABC is a triangle with a right angle at C, CB s 30 ft. long and BAC is 20°. If CB is produced to a point P, such that PAC is 55°, calculate the length of CP. (*Science and Art*, 1882.)



Angle BAC=20°, ∴ angle ABC=70° (I. 32), and angle PAB =35°;

But angle ABC=angles APB, PAB, (I. 32.)

∴ angle APB=35°,

and therefore BP=BA (I. 6).

In the triangle ABC,

AB : BC :: Sin ABC : Sin BAC
AB : 30 :: Sin 90° : Sin 20°
AB : 30 :: 1 : ·3420201
∴ AB=30÷·3420201
=87·714...

∴ CP=CB+BP
=(30+87·714...) ft.
=117·714...ft. Ans.

Note.—Stage 3. *Todhunter's* 'Algebra for Colleges and Schools'; *Potts'* 'Euclid'; *Todhunter's* 'Plane Trigonometry,' or 'Spherical Trigonometry.' *Stage* 4. *Drew's* 'Conic Sections'; *Todhunter's* 'Conic Sections.'

25. SHEEPY.—Although we have spent a considerable time over your equation, we cannot obtain a solution, and therefore must believe the mathematical tutor at the college must have given it incorrectly.

26. MANACLES.—(1) Get your secretary to write to the Department for the form. (2) *Cornwell's* 'Geography.' (3) No.

27. NOTNAPS.—'She is not *so* good a scholar *as* he is.'
So—Adv. of man. mod. the adj. 'good.'
As—Conj., Copulative, joining the sentences 'she is not so good a scholar,' and 'he is a good scholar.'

28. W. R.—(1) The surface will be level. (2) The pressures depend on the area of the surface and the depth. (3) The pressure is proportional to the depth. (4) If a sliding-scale were attached to the gauge, the variations in pressure could be noticed.

29. CARRIE.—Send for copy of terms to the Secretary, Wesleyan Training College, Horseferry Road, Westminster, S.W. The terms vary from time to time.

30. AUGUSTINE.—No: must be advanced section.

31. PETO.—It is desirable, but not necessary, to do so. The fee will be paid.

PERPLEXED.—(1) No. (2) The candidate must apply himself, having obtained permission from the Department to sit before October 1st. Fee nominal. (3) No. (4) Produced at the examination.

——o——

We are pleased to announce that Mr. Wrightson has been appointed lecturer at South Kensington in the new Department of Agricultural Chemistry, and that the practical instruction will be in charge of Mr. Chapman-Jones.

SPECIMEN. No charge should be made for this Copy.

WELL BEGUN HALF DONE

THE LITTLE LEARNER

A Monthly Educational Magazine. Specially adapted for use in the First three Standards of Public Elementary Schools.

Conducted by JOSEPH HUGHES.

No. 1. Vol. I. DECEMBER, 1882. Price ½d. Per post, 12 copies with Answer Card for 6½d.

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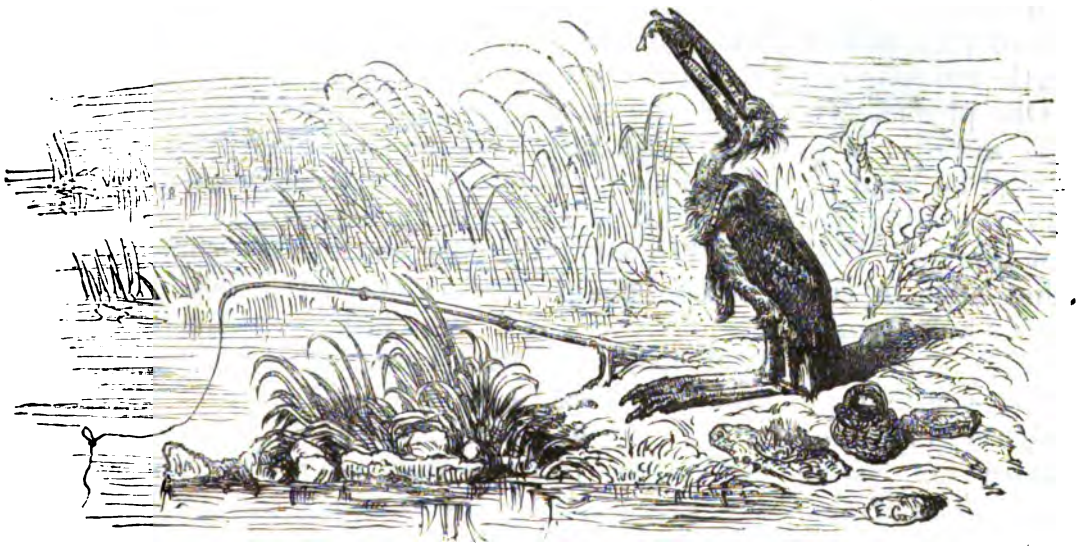
ÆSOP'S FABLES.



THE ANGLER AND THE LITTLE FISH.

One day an ang-ler caught a lit-tle fish with his line and hook. He was glad to catch this fish, for he had wait-ed a long time. Just as he was go-ing to eat it, he heard the fish say, 'Oh, sir; stop,

If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

please! I am such a wee, wee fish. I am not half-grown. Put me back in-to the stream. I shall soon grow to be a big fish. Do let me swim in the brook, and come and catch me a-gain. In a few weeks I shall be fit to be cooked. I should then fill a large dish. Please, sir, let me go this time.' When the lit-tle fish had made his long speech, the ang-ler said, 'Catch me a-gain! is that what you say? No! no! my wee friend. It is true you are small, but three like you will serve to-day for my din-ner. If I let you swim a-way this time you will take care not to come here a-gain. I have you now, and I shall gob-ble you up.'

THE LI-ON AND THE MOUSE.

A GREAT li-on was fast a-sleep one day when a ti-ny mouse ran over his face and woke him up. The li-on was very ang-ry with the little mouse, and lift-ed his great paw to kill him. But poor little mou-sie cried out and said, 'Oh, please, Mr. Li-on, do not eat me up; if you will pit-y me I will be kind to you some day.' So the li-on laughed loud and let him go. He laughed to think that such a tin-y mouse could ev-er help him.

Not very long af-ter this, the li-on was caught and held fast with a very strong rope. As he could not move he be-gan to roar. The lit-tle mouse heard the roar of his friend a long way off, and came in great haste to see what was the mat-ter, or why he made such a dread-ful noise.

'Oh, I see,' said the mouse; 'I will soon let you out.' At once he be-gan to nib-ble at the rope, and he nib-bled and nib-bled un-til the thick rope was eat-en quite through.

The great li-on then rose up and thanked the lit-tle mouse.

'You laughed when I told you that I might help you some day,' said little mou-sie. 'You were kind to me; I am glad to show you that e-ven a ti-ny mouse can be of some use to a great li-on.'

THE BEAR AND THE TRAV-EL-LERS.

Two men were walk-ing in the for-est one fine day, and talk-ing in a loud voice as they went a-long. Just as they came un-der

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a very large tree a bear came out on the path-way. One of the men quick-ly climbed the tree and hid him-self in the branch-es. The other trav-el-ler was left a-lone, for he could not jump well, nor could he run ve-ry fast. So he fell down on the ground and seemed as if he was dead. When the bear came up to him he smelt him all o-ver, from his feet to his head. The man kept his breath, and the bear soon went a-way. When he was out of sight, the other trav-el-ler came down from his hi-ding-place. 'What did the bear whis-per to you,' said he, 'when he put his snout close to your ear?' 'The bear gave me good ad-vice, for he told me nev-er to go out in-to the for-ests with a man who will run a-way from his friend in time of dan-ger.'

THE MIL-LER, HIS SON, AND THEIR ASS.

A MIL-LER said to his son one day, 'Fetch the don-key from the field; we will drive him to the town and sell him.' The lad soon brought the ass to his fa-ther, and they both start-ed for the town, driv-ing the don-key be-fore them. They had not gone far when some i-dle wo-men cried out: 'Look! what two sil-ly fel-lows they are to be walk-ing this hot weather when they might

If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

ride!' The mil-ler then said to his son, 'Get up, my lad, I will walk a-long by your side.' Furth-er on the road they pass-ed some old men. 'There!' said one of them, 'look at that i-dle young fel-low, ri-ding at ease whilst his poor old fa-ther has to walk. I was just tel-ling you that lit-tle re-spect is shown to grey hairs.' 'Get down at once, you la-zy lad, and let your old fa-ther ride. He must be tired e-nough.' The mil-ler then told his son to get off; and, to please the old men, he rode the ass him-self. When they had gone a lit-tle way fur-ther a num-ber of wo-men and chil-dren cried out to-geth-er: 'What a shame! what a shame! How can you ride and make that lad walk such a day as this?' So, to please these wo-men, the good-na-tured mil-ler took up his son be-hind him. As they came near the town a man stopped them, and said to the mil-ler, 'Pray, is that ass your own?' 'Yes,' said the old man. 'Well, I should not have thought so,' said the other, 'by the load he has to car-ry. I am sure you two are bet-ter a-ble to car-ry the ass than the ass is to car-ry you.' 'We will try to please you,' said the mil-ler, as he got down with his son. So they first put a pole be-tween the legs of the ass. They then lift-ed the pole on their shoulders and tried to car-ry the don-key o-ver the bridge they had to cross. The peo-ple came out in crowds to laugh at such a sight as this. The ass did not much like to be car-ried in this strange way. So, when he heard the shouts and laugh-ter of the crowds, he be-gan to kick. The pole broke, and down fell the ass in-to the riv-er be-low!

'Ah!' said the mil-ler, as he went with his son, 'I have been very fool-ish in what I have done. I have tried to please all, and yet I pleased none. See what it has cost me! my don-key is gone!'

THE ASS, THE FOX, AND THE LI-ON.

An ass and a fox a-greed to hunt to-geth-er in the for-ests, and to help each oth-er in time of dan-ger. They soon met a li-on, and they were both much a-fraid. But the fox thought he would save his own life, so he said to the li-on, 'If you will pro-mise not to hurt me I will man-age to con-trive for you to catch the ass.' 'Ve-ry well,' said the li-on, 'you shall not be hurt if I can se-cure the

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ass.' Then off went the fox, and led the ass to a deep pit. When the li-on saw that the ass was safe in the pit he made a meal of the sly fox first, and said he would keep the ass for an-oth-er day.

THE MAN AND THE LI-ON.

A MAN and a li-on were once trav-ell-ing to-geth-er through the for-est. Both were boast-ing of their bra-ver-y and of their strength. In one part of the forest was a stone sta-tue, the like-ness of a li-on be-ing killed by a man. 'See here!' said the man, 'the sculp-tor shows how strong we are, strong-er e-ven than the li-on, the King of Beasts.'

'Yes, yes,' said the li-on, 'but the sculp-tor was a man. If we li-ons could carve sta-tues, you would see the like-ness of a man un-der the paw of the li-on.'

GRAMMAR. (INTRODUCTORY).

Men, women, and children can think.

What a man thinks is called a **thought**.

If he wishes to express that thought he **speaks**.

When a man speaks he uses **words**.

Speaking, or the using of words, is called **speech**.

Cats, dogs, cows, horses, and other animals can make a noise, but they cannot speak.

They mew, bark, bellow, or neigh, and make nearly the same noises over and over again.

They have not the power of speech.

Some birds, like the parrot, can be taught to say words, but they cannot think and speak like men, women, and children.

There are many kinds of speech.

The speech of a boy is his **language**, or his **tongue**.

Children in England speak the **English language**.

The boys and girls of France use the French tongue.

There are hundreds of tongues, or languages, in the world.

Some English boys and girls learn to speak one or two languages besides their own.

People who speak a language that we do not know, cannot tell us what they think.

The words which they use have no meaning to us, and so we cannot understand their thoughts.

There are many thousands of words in the English language.

Boys and girls speak their own tongue well when they always use the right words to express their thoughts.

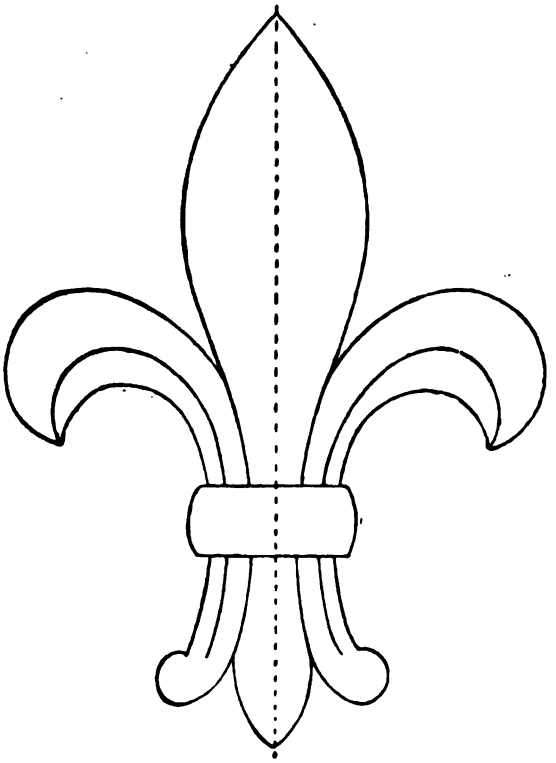
Children must know the meanings of all the words they use, before they can speak correctly.

Every English child should try to speak good English.

Words are of one or more sounds. Each sound is a **syllable**.

If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

DRAWING LESSON.



Lines Worth Learning.

THE RIV-ER.

On the side of yon-der moun-tain,
Ev-er clad in pur-est snow,
As a lit-tle crys-tal foun-tain
I at first be-gan to flow.

Right and left, as I was go-ing,
Oth-er foun-tains joined with me;
And our wa-ters, al-ways grow-ing,
Trot-ted on right mer-ri-ly.

In a chan-nel, deep and nar-row,
Midst old moss-grown rocks we sped,
Rush-ing swift-ly, like an ar-row,
Rush-ing to a low-er bed.

When the sum-mer's sun was beam-ing
Strong-est at his noon-tide glow,
Help-ing stream-lets then came gleam-ing
Trick-ling from the ice and snow.

But at times it grew so cloud-y
That the sun was hid from sight;
Peals of thun-der, roar-ing loud-ly,
Fol-lowed ev-er-y flash of light.

Hail and rain came with the thun-der,
Swell-ing all our wa-ters so
That the rocks we broke a-sun-der,
For we scarce had room to grow.

Still the rap-id streams were com-ing,
Deep and rap-id, from the rain,
Dash-ing, splash-ing, roar-ing, foam-ing,
Down the hill-side to the plain.

When such tem-pests had blown ov-er,
Oft I saw the cheer-ful bow,
Seem-ing like an arch to cov-er
All the hol-low vale be-low.

Here be-neath the qui-et shad-ows
Of the wil-lows bend-ing low,
By the side of new-mown mead-ows,
Much more gent-ly may we flow.

Nois-y bil-lows now no long-er,
As when shal-low, can there be;
Wid-er, deep-er, smooth-er, strong-er,
Roll-ing on-wards to the sea.

All the streams now make one riv-er,
And my name to all is known.
Will you, chil-dren, will you ev-er
Quite for-get how I have grown?

'THE LITTLE LEARNER' FIRST

Money Prize Competition.

The first **Writing Competition** will be for **Five Guineas**, divided into the following **Twelve** prizes:—

1st, One Guinea; 2nd, 17/6; 3rd, 15/-; 4th, 10/6; 5th, 10/-; 6th, 7/6; 7th, 6/6; 8th, 5/-; 9th, 4/-; 10th, 3/6; 11th, 2/6; 12th, 2/-

Any Scholar **under NINE years** of age on January 1st, 1883, may compete in *The Little Learner's* Prize Competition. Nos. 5 and 6 (both books) Cox's Copy Books, are to be written and sent to Mr. JOSEPH HUGHES, Office of *The Little Learner*, Pilgrim Street, Ludgate Hill, E.C., not later than Feb. 1st, 1883.

No Copy Books sent in can be returned.

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READINGS IN GEOGRAPHY.

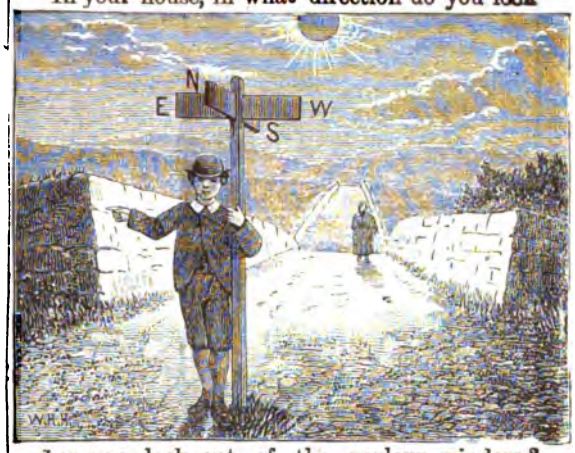
By John R. Langler, B.A., F.R.G.S.,
One of the Examiners in Geography to College of Preceptors.

STANDARD I.—NORTH, EAST, SOUTH, WEST.

When the sun shines it is day, and when the sun has set it is night. The light of day begins with the dawn in the morning. When the sun is high-est in the sky it is noon, or mid-day; when the sun be-gins to go down it is afternoon, or af-ter twelve o'clock.

The sun ri-ses in the East and sets in the West every day of the year. In England, the sun at noon is al-ways towards the South. If I walk on a road towards the set-ting sun I am go-ing to-wards the West; if I run the other way I am going towards the East, where the sun rises in the morning. When I go towards the South, any man that may meet me is go-ing towards the North.

Here is a picture of a boy close to a post in the middle of the road. The sun is as high as it can be, and is shining brightly on the two walls. So it is noon, and the sun is towards the south. The boy wants to know all about East, West, North, and South. He has his back towards the sun in the South at noon, so he is looking towards the North. His right hand is pointing towards the East, and his left hand holds the post on the West. The man that is coming behind him from the South is on his way towards the North. If the boy were to turn round and meet the man, tell me in which direction would he have to go?



In your house, in what direction do you look when you look out of the parlour window? What can you see on the South side of your house? Is the church North, East, South, or West of you? In what direction do you run home from school?

GEOGRAPHY.

STANDARD II.—ABOUT A LAKE.

How fast the rain is fall-ing! I can hear the rain-drops pat-ter on the pave-ment. They seem to dance a-gain. The clouds are high, and the big drops of wa-ter have a long way to fall. No won-der they make such a noise and such a splash. What a heav-y show-er!

Part of the rain soaks in-to the ground, and part rolls a-way to the sides of the road. Look at the streams at the edge of the pave-ment. The gut-ters are quite full. But in the mid-dle of the road are lit-tle pools of wa-ter which can-not run a-way. No! the rain is caught in the hol-lows which are made by the iron hoofs of hors-es or by the wheels of carts and coach-es. But see! one pool is full and the wa-ter is run-ning o-ver the edge. It flows a-long in a ti-ny rill to the gutter. This must be a thun-der show-er. At the bot-tom of the mea-dow yon-der there is a deep hol-low. Will the rain fill that, I won-der? Yes! there will be no streams through the grass, but it will soon find its way to the cor-ner at the bot-tom. The hol-low pit was dug in the field that the hors-es might have a large pool at which to drink. It is called the horse-pond. Look! the pond is get-ting full and I ex-pect it will o-ver-flow.

In some low places there is room for a ver-y much lar-ger pond. The wa-ter is so deep that boats and even ships of great size can swim on it. Such a very large pond is called a lake. Some lakes are so long and so wide that you can-not see a-cross them. But lakes like these are not found in our own land.

When wa-ter lies on land that is low,
It forms a *pool*, or a *pond*, or a *lake*, you know.

A Lake is water surrounded by land.

If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

GEOGRAPHY. STANDARD III.

England is a part of a very large island which is called **Great Britain.**

On the North of England is **Scotland,** and on the West is **Wales.**

Ireland is a large island West of Great Britain, and its chief city, Dublin, can be reached by a steam-boat in four or five hours from Holyhead, the nearest town in Wales. The **St. George's Channel** is here about sixty-five miles across.

The **Isle of Man** lies nearly half-way between England and Ireland in the Irish Sea. Still further North, some peninsulas of Scotland jut out towards the Irish Coast and form a strait called the **North Channel,** less than thirty miles wide.

On the East side of Great Britain is the **North Sea,** and on the South is the **English Channel,** which separates England from France.

The two large islands, and some hundreds of smaller ones, are together named "**The British Isles.**" The whole group lies west of the continent of **Europe,** and on the Eastern side of the **North Atlantic Ocean.**

Dover, in the South-east, is the English town nearest to France. The **Strait of Dover** is about twenty miles wide, and forms a passage for ships from the English Channel to the North Sea.

West of Ireland is the continent of **America,** three thousand miles away.

The British Isles are sometimes spoken of as the **United Kingdom of Great Britain and Ireland.** There are countries in other parts of the world which are also included in the **British Empire.**

England, including Wales, forms the largest part of Great Britain. This country is much broader in the South than in the North. It would take four times as long to travel from Cornwall in the South-west to Kent in the South-east as it would to cross from the coast of Irish Sea to the shores of North Sea. We should have to ride more than **three hundred miles,** even if we could go in a straight line. It is nearly three hundred miles from the Welsh coast to the North Sea on the East.

But the very narrowest part of England is in the North, near Scotland. We could there cross the country from shore to shore in a journey of only **sixty miles.**

The coast line of England is much broken, especially on the western side, where the hills are more numerous and form bold headlands. Between these capes are many **bays** and **harbours** for the shelter of ships.

Any one who could sail along the whole of the coast of England close to the shore in the North Sea, the English Channel, the Bristol Channel, the St. George's Channel, and the Irish Sea, would have a very long voyage of about **two thousand miles.**

He would pass the beautiful **Isle of Wight** on the South coast, the **Scilly Islands** off Cornwall, and **Anglesea,** the Welsh island on which is the town of Holyhead.

Near the East coast there are very few islands; the largest is **Holy Island.**

The mariner in the North Sea has to watch lest his ship should be driven on the quicksands off **Yarmouth,** or on the **Goodwin Sands** off Kent. On these sand-banks many ships are wrecked every year.

The chief dangers for sailors on the western coasts are the rocks, which are numerous near the shore, and often lie hidden beneath the waters. Lighthouses are built on many headlands, or on some of the most dangerous rocks, like the **Eddystone** in the English Channel. Light-ships are also moored near the dreaded sand-banks, to warn the sailor during the darkness of the night.

EXERCISES.

In what direction is England from Scotland? What island lies East of Ireland? What countries are in Great Britain. Name the boundaries of England Name five islands near England. In what direction would you travel from England to Scotland? or to France? or to Ireland? Where are the Yarmouth Sands? or the Goodwin Sands?

In what part of England is Kent? Cornwall?

Name an island in the English Channel, or in the Irish Sea, or on the coast of Wales.

Where is England broadest? or narrowest?

On which coast are rocks most numerous?

How are the bays formed?

London is the chief city in the world.

24. COOPE.—ABC is a triangle with a right angle at C, CB s 30 ft. long and BAC is 20°. If CB is produced to a point P, such that PAC is 55°, calculate the length of CP. (*Science and Art*, 1882.)

sington in the new Department of Agricultural Chemistry, and that the practical instruction will be in charge of Mr. Chapman-Jones.

ARITHMETIC. STANDARD I.

A.

(1)	(2)	(3)
1	2	3
2	1	4
3	4	2

B.

(1)	(2)	(3)
3	4	5
1	2	4
4	5	1
2	3	6

C.

(1)	(2)	(3)
4	6	9
6	2	8
3	8	7
7	5	6

D.

(1)	(2)	(3)
12	42	35
20	13	12
43	25	63
24	34	46

E.

(1)	(2)	(3)
53	28	64
47	90	58
14	36	95
85	79	47

F.

(1)	(2)	(3)
37	9	16
4	48	32
92	36	97
6	17	54
83	5	89

G.

(1)	(2)	(3)
509	234	753
142	670	198
617	329	642
385	816	539

H.

(1)	(2)	(3)
435	840	376
92	7	513
608	69	782
53	2	657
724	938	498

I.

(1)	(2)	(3)
3	6	9
1	3	4

J.

(1)	(2)	(3)
15	37	86
12	23	41

K.

(1)	(2)	(3)
364	709	648
140	302	12

L.

(1)	(2)	(3)
34	65	87
18	39	78

M.

(1)	(2)	(3)
456	607	729
219	543	95

N.

(1)	(2)	(3)
850	235	103
367	96	8

O.

(1)	(2)	(3)
2,407	5,316	9
680	9	87
39	472	654
48	8,050	3,201
3,065	98	9,990

P.

(1)	(2)	(3)
6,537	9,420	4,306
2,941	8,705	728

STANDARD II.

A.

(1)	(2)	(3)
3,076	7	34
842	58	907
9	362	5
47,305	5,009	14,392
94	724	8,060
630	80,916	75,489

B.

(1)	(2)	(3)
70,486	43,219	19,805
69,708	5,082	937

C.

(1)	(2)	(3)
68,070	30,761	100,000
57,984	19,765	90,909

D. (1) 14,203 × 2
(2) 35,082 × 3
(3) 57,146 × 4

E. (1) 47,359 × 7
(2) 68,425 × 9
(3) 90,867 × 12

F. (1) 29,046 × 60
(2) 73,819 × 80
(3) 85,493 × 110

G. (1) 53,817 × 14
(2) 94,076 × 36
(3) 69,584 × 64

H. (1) 37,049 × 17
(2) 47,296 × 49
(3) 75,168 × 95

I. (1) 85,738 × 123
(2) 56,940 × 207
(3) 39,675 × 580

J. (1) 64,507 × 609
(2) 29,384 × 860
(3) 98,736 × 978

K. (1) 42,068 ÷ 2
(2) 39,612 ÷ 3
(3) 64,368 ÷ 4

L. (1) 75,360 ÷ 5
(2) 90,744 ÷ 6
(3) 86,415 ÷ 7

M. (1) 47,013 ÷ 8
(2) 60,507 ÷ 11
(3) 58,639 ÷ 12

N. (1) 735,846 × 3,709
(2) 280,395 × 6,840
(3) 517,928 × 7,006

O. (1) 658,397 ÷ 90
(2) 374,182 ÷ 32
(3) 909,909 ÷ 121

STANDARD III.

A. (1) 16,991 ÷ 13
(2) 41,752 ÷ 17
(3) 92,046 ÷ 29

B. (1) 270,805 ÷ 34
(2) 509,273 ÷ 47
(3) 634,718 ÷ 58

C. (1) 375,960 ÷ 73
(2) 482,374 ÷ 86
(3) 950,285 ÷ 95

D. (1) 1,273,019 ÷ 104
(2) 3,086,947 ÷ 237
(3) 2,345,678 ÷ 490

E. (1) 5,109,320 ÷ 642
(2) 8,427,506 ÷ 785
(3) 9,008,793 ÷ 999

F.

(1) s.	d.	(2) s.	d.	(3) s.	d.
4	7½	13	6½	18	9¾
2	9	8	4¾	14	7½
5	6½	17	11½	19	1¾
3	8	9	3	12	10½
1	5½	16	2¼	15	8½

G.

(1) £	s.	d.	(2) £	s.	d.	(3) £	s.	d.
3	6	10¾	6	15	7½	9	16	4½
5	19	8½	8	18	0¼	0	17	10½
7	12	11	4	13	9¾	5	8	6¾
2	7	6¼	9	10	4½	0	19	11
9	14	3¾	7	17	8¾	8	12	5½

H.

(1) £	s.	d.	(2) £	s.	d.	(3) £	s.	d.
24	17	3½	905	18	6¾	4,073	15	8½
50	14	9½	74	9	11½	9	13	3¾
37	19	10¾	528	15	7¼	7,520	18	6¼
68	16	8¼	6	13	2½	948	17	10
92	11	4¾	847	16	9¾	6,256	19	11¾

I.

(1) d.	(2) d.	(3) d.
9½	10¾	7¼
4¼	2⅝	5½

J.

(1) s.	d.	(2) s.	d.	(3) s.	d.
8	5¾	14	7½	19	10½
3	9½	9	3¾	15	10⅝

K.

(1) £	s.	d.	(2) £	s.	d.	(3) £	s.	d.
7	16	4	9	14	6½	12	12	7
2	11	7¼	4	18	0¾	9	15	8¾

L.

(1) £	s.	d.	(2) £	s.	d.	(3) £	s.	d.
37	0	8¾	507	13	9½	8,065	17	3½
28	14	10¾	87	16	11	7,698	19	7⅛

If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

FARTHINGS TABLE.

f.		d.	f.		d.
4	are	1	13	are	3¼
5	—	1¼	14	—	3½
6	—	1½	15	—	3¾
7	—	1¾	16	—	4
8	—	2	17	—	4¼
9	—	2¼	18	—	4½
10	—	2½	19	—	4¾
11	—	2¾	20	—	5
12	—	3	21	—	5¼

PENCE TABLE.

d.		s.	d.	d.		s.	d.
12	are	1	0	70	are	5	10
20	—	1	8	72	—	6	0
24	—	2	0	80	—	6	8
30	—	2	6	84	—	7	0
36	—	3	0	90	—	7	6
40	—	3	4	96	—	8	0
48	—	4	0	100	—	8	4
50	—	4	2	108	—	9	0
60	—	5	0	110	—	9	2

SHILLINGS TABLE.

s.		£	s.	d.	s.		£	s.	d.
20	are	1	0	0	65	are	3	5	0
25	—	1	5	0	70	—	3	10	0
30	—	1	10	0	75	—	3	15	0
35	—	1	15	0	80	—	4	0	0
40	—	2	0	0	85	—	4	5	0
45	—	2	5	0	90	—	4	10	0
50	—	2	10	0	95	—	4	15	0
55	—	2	15	0	100	—	5	0	0
60	—	3	0	0	105	—	5	5	0

Twice			3 Times			4 Times			5 Times			6 Times		
1	are	2	1	are	3	1	are	4	1	are	5	1	are	6
2	„	4	2	„	6	2	„	8	2	„	10	2	„	12
3	„	6	3	„	9	3	„	12	3	„	15	3	„	18
4	„	8	4	„	12	4	„	16	4	„	20	4	„	24
5	„	10	5	„	15	5	„	20	5	„	25	5	„	30
6	„	12	6	„	18	6	„	24	6	„	30	6	„	36
7	„	14	7	„	21	7	„	28	7	„	35	7	„	42
8	„	16	8	„	24	8	„	32	8	„	40	8	„	48
9	„	18	9	„	27	9	„	36	9	„	45	9	„	54
10	„	20	10	„	30	10	„	40	10	„	50	10	„	60
11	„	22	11	„	33	11	„	44	11	„	55	11	„	66
12	„	24	12	„	36	12	„	48	12	„	60	12	„	72

24. COOPE.—ABC is a triangle with a right angle at C, CB s 30 ft. long and BAC is 20°. If CB is produced to a point P, such that PAC is 55°, calculate the length of CP. (*Science and Art*, 1882.)

sington in the new Department of Agricultural Chemistry, and that the practical instruction will be in charge of Mr. Chapman-Jones.

SPELLING.

COMPILED FROM THE MOST POPULAR READING BOOKS.

STANDARD I.

1	3	5	7	9	11
Aunt	break-fast	drives	floor	im-prove	pleas-ed
an-gry	butch-er	dais-ies	farm-yard	In-di-an	play-ed
a-gain	chair	di-vide	fa-ther	knew	play-mates
a-gainst	cream	dread-ful	grown	kneel	pres-ent
a-stray	catch	each	grasp	keen-ly	pre-pare
an-other	caught	eyes	good-bye	learn-ed	pic-ture
any-thing	could	eas-i-ly	greed-y	meant	quite
builds	course	fear-ed	gath-er	mis-chief	quick-ly
2	**4**	**6**	**8**	**10**	**12**
bread	cheese	frisk	grum-ble	morn-ing	qui-et
birth	cra-dle	fright	haste	mead-ow	romps
bought	cheer-ful	friend	hedge	neith-er	rov-ing
brother	cro-cus	faint	health-ful	once	re-peat
but-ter-fly	chas-ing	folks	hon-ey	o-ther	roll-ed
bright-en	clev-er	field	hap-pi-er	or-ange	re-joice
be-cause	car-ri-ed	frocks	hol-i-day	piece	reach-ed
branches	charm-ing	flow-er	i-dle	prim-rose	shoes

STANDARD II.

1	3	5	7	9	11
aft-er-wards	crumbs	dan-de-li-on	feath-ers	known	perch-ed
af-fec-tion-ate	ca-reer	dif-fer-ent	float-ed	la-bours	pitch-er
ad-vice	chim-ney	di-rec-tions	fur-ther	low-li-est	peo-ple
an-swer	crea-tures	de-ci-sive	fal-len	light-heart-ed	play-fel-low
beet-les	clasp-knife	dare-say	guess	lan-guage	pret-ti-er
bus-y	col-ours	e-ter-nal-ly	good-na-ture	laugh-ed	per-ish-ed
breez-es	crys-tal	earth-ly	gnaw-ed	mer-ri-ly	plea-sure
break-fast	care-ful	en-joy-ed	hun-gry	ma-ter-nal	per-haps
2	**4**	**6**	**8**	**10**	**12**
beau-ti-ful	cher-ries	e-vi-dent-ly	hov-els	mon-keys	pars-ley
buck-et-ful	chasm	en-ough	hatch-ed	min-utes	punc-tu-al
be-gin-ning	dis-tance	en-clos-ed	hew-ing	non-sense	pad-dling
be-lieve	droop-eth	em-ploy-ed	hor-ror	nib-bled	pres-ent
col-o-nies	de-light-ful	ei-ther	in-clin-ed	o-blig-ed	quar-rel
cous-ins	drown-ed	edg-es	in-vi-ta-tion	pres-sure	ques-tion
con-quer	dis-ap-point-ed	fru-gal	joy-ous	pa-tience	quench
crawl-ing	dumb	fu-ner-al	kitch-en	par-tic-u-lar	ra-di-ance

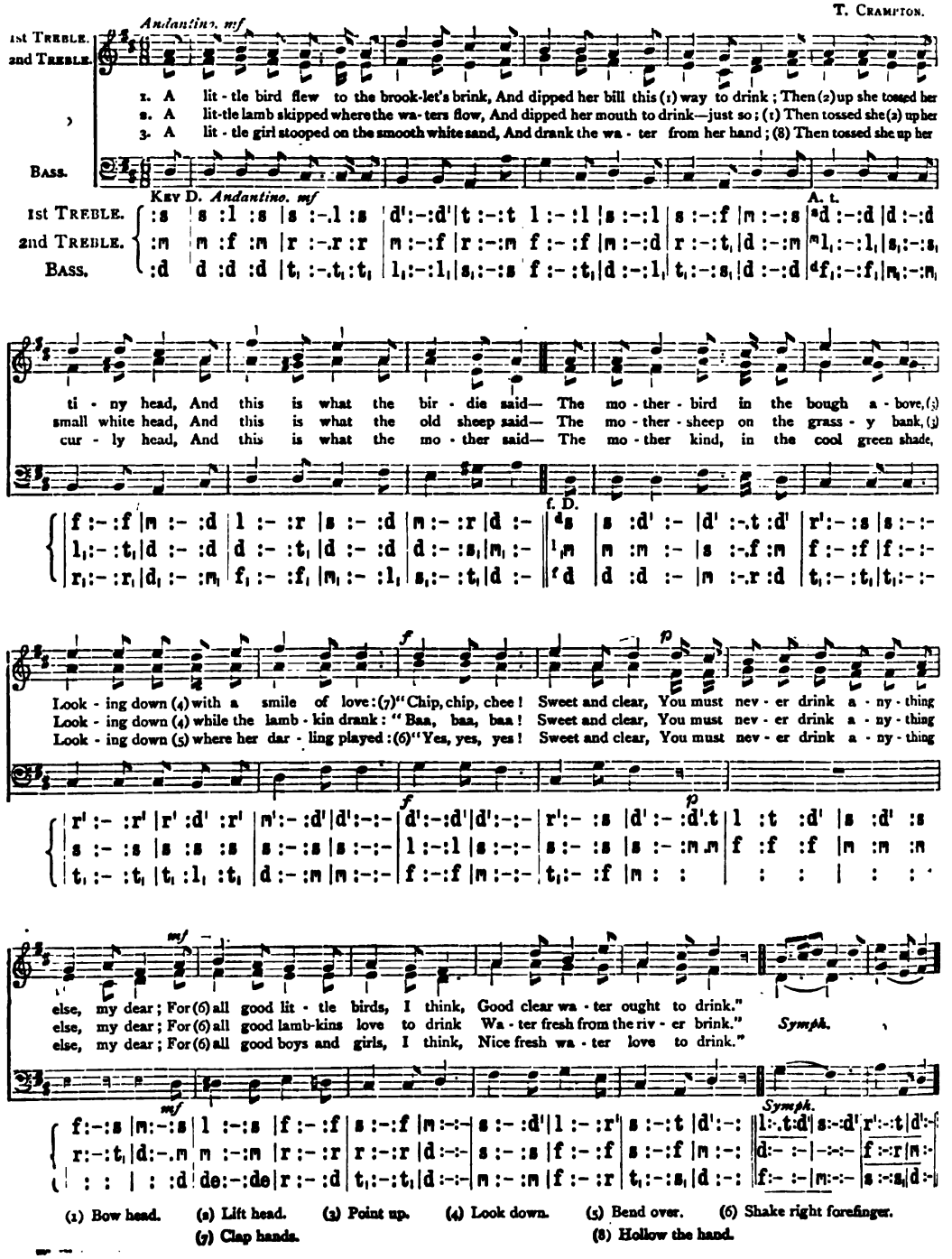
STANDARD III.

1	3	5	7	9	11
at-tempt	car-ri-a-ges	dif-fi-cul-ty	for-tu-nate-ly	light-ning	op-por-tu-ni-ty
at-ten-tion	con-science	dis-cov-er	for-feit	lone-li-ness	o-be-di-ent
ap-pren-tice	civ-i-liz-ed	dis-o-bey	gen-er-a-tion	le-o-pard	oc-cur-red
Al-giers	cu-ri-os-i-ty	de-liv-er-ance	gal-lop-ing	lux-u-ry	pre-sump-tu-ous
ap-pe-tite	coun-ten-ance	de-lay-ed	gen-u-ine	ma-tron-ly	per-ti-nac-i-ty
ab-solv-ed	car-ess-es	de-spair	her-o-ine	mar-gin	par-tic-u-lar
ap-par-ent	con-ver-sa-tion	de-gra-ding	hu-mour-ed	ma-chine	pos-i-tion
an-guish	cau-tious-ly	de-li-cious	im-me-di-ate-ly	mul-ti-plied	prop-er-ty
2	**4**	**6**	**8**	**10**	**12**
a-dieu	com-pe-tent	di-rect-ly	in-dig-na-tion	mu-se-um	prac-tis-ed
buf-fa-loes	cer-tain-ly	ex-cel-lent	in-clines	mel-o-dies	pa-tient
blithe-ly	cel-lar	ef-fect-ive-ly	in-tro-duce	naught-y	pro-ceed
beau-ti-fy	con-quer-ed	ed-u-ca-tion	ig-no-rant	nur-ser-ies	quiv-er-ed
be-at-i-tude	change-ful	e-choes	is-land	nau-se-ous	re-ceiv-ing
bril-li-ant	de-ter-min-ed	ex-haus-ted	in-ter-course	neigh-bours	re-ceipt-ed
brief-ly	down-heart-ed	ex-cit-ed	im-ped-i-ments	ne-ces-sary	res-o-lu-tion
col-umn	de-lib-er-ate	ear-nest	lo-co-mo-tive	or-din-ary	re-fer-red

(The Answers to the Arithmetic in this number will appear in our next issue. They are printed in the December Number of the *Practical Teacher* and the *Governess*. Now ready, Answer-cards, which also contain the Answers to the sums in the *Scholar*, a Monthly Paper specially designed for Standards IV., V., VI. and VII.)

the clothes are soaked with water, this is not so easy. If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of ding nor carbolised oil are at hand, the burnt part may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

WATER TO DRINK.

T. Crampton.

Andantino. mf
1st Treble.
2nd Treble.
Bass.
1. A lit - tle bird flew to the brook-let's brink, And dipped her bill this (1) way to drink ; Then (2) up she tossed her
2. A lit-tle lamb skipped where the wa- ters flow, And dipped her mouth to drink—just so ; (1) Then tossed she (2) up her
3. A lit - tle girl stooped on the smooth white sand, And drank the wa - ter from her hand ; (8) Then tossed she up her
Key D. Andantino. mf
A. t.
ti - ny head, And this is what the bir - die said— The mo - ther - bird in the bough a - bove, (3)
small white head, And this is what the old sheep said— The mo - ther - sheep on the grass - y bank, (3)
cur - ly head, And this is what the mo - ther said— The mo - ther kind, in the cool green shade,
f. D.
Look - ing down (4) with a smile of love : (7) "Chip, chip, chee ! Sweet and clear, You must nev - er drink a - ny - thing
Look - ing down (4) while the lamb - kin drank : "Baa, baa, baa ! Sweet and clear, You must nev - er drink a - ny - thing
Look - ing down (5) where her dar - ling played : (6) "Yes, yes, yes ! Sweet and clear, You must nev - er drink a - ny - thing
else, my dear ; For (6) all good lit - tle birds, I think, Good clear wa - ter ought to drink."
else, my dear ; For (6) all good lamb-kins love to drink Wa - ter fresh from the riv - er brink."
else, my dear ; For (6) all good boys and girls, I think, Nice fresh wa - ter love to drink."
Symph.
Symph.

(1) Bow head. (2) Lift head. (3) Point up. (4) Look down. (5) Bend over. (6) Shake right forefinger.
(7) Clap hands. (8) Hollow the hand.

IMPORTANT NOTICE.—Now Ready, Price ½d., No. 2, Vol. II., of the *Scholar*, a Monthly Illustrated Paper, specially designed for Standards IV., V., VI., and VII. Contents :—Robinson Crusoe (beautifully illustrated), Shakspere's Richard II. Annotated, Arithmetic, How we are made, Domestic Economy, Big Wonders for Little Heads, or Science Lessons for Young Learners, Drawing, Writing Money Prize Competition, Original School Song, Latin Prefixes with Examples, Dictionary of Difficult Words with their Derivation.

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24. Coope.—ABC is a triangle with a right angle at C, CB s 30 ft. long and BAC is 20°. If CB is produced to a point P, such that PAC is 55°, calculate the length of CP. (*Science and Art*, 1882.)

sington in the new Department of Agricultural Chemistry, and that the practical instruction will be in charge of Mr. Chapman-Jones.

THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),

Vice-President of the British Medical Association.

X.

BURNS, SCALDS, AND CORROSIVE ACIDS.

THERE is nothing so terrifying as a person on fire. The moment a child is in flames it loses all power of control, and but too often common sense is lost among those who witness the misfortune. The mind appears to be paralysed. If a child is seen to be in flames, wrap something round it as quick as thought, and throw the sufferer on to the ground; if nothing else is at hand take off your coat, or a mat, a tablecloth, anything which will not burn rapidly. If nothing is at hand roll the child over and over on the ground, but don't let it run about. If it is your coat which is used, or whatever else it may be, press it lightly down and smother the flames; they will then extinguish themselves. Recollect that the child must be made to lie down and kept on the ground, and not allowed to stand upright. If water is at hand so much the better, but don't let the child run some distance to a water supply; make it lie still, and let some one fetch the water to it, if they like. The accident happens more often to girls than to boys, from the more inflammable nature of their clothes. As soon as the fire is extinguished don't proceed to pull off the burnt articles. You may get some water and moisten the burnt part, because there may be smouldering fire ready to burst out again if air be admitted. If you are certain that there is nothing which can do so, don't use the water at all; be careful not to expose the burnt part to the action of the air, and if possible keep away all cold air. The burnt material is the best covering that can be used; it is charcoal and an antiseptic of itself. It is a serious error to clear off all the burnt substance. As soon as the fire is perfectly extinguished, cover up everything as quickly as possible that does not come away without tearing. If the clothes are soaked with water, this is not so easy. If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of course it should be at once used to extinguish the fire, as being most rapidly and immediately effective; but it is worse than useless to apply water after the fire has been extinguished; and then to tear off the charred clothing, bringing the skin with them, is bad treatment. Cut the clothing away and leave the adhering parts *in situ*.

The succeeding treatment resolves itself into three sections. First, that to be adopted to remove the incidence of the shock to the system, which is usually great; second, that for the immediate treatment of the burnt part; and third, the subsequent course to be adopted to cure the burns. The shock is sometimes so great that life is lost, without any attempt at rally being made. Examine the hands and feet; if they are cold, and if there is scarcely any pulse to be felt, it may be advisable to administer a few teaspoonfuls of brandy-and-water every few minutes until the pulse returns. Use hot bottles to the extremities. If a cup of hot tea can be rapidly obtained it will be better than the alcoholic liquid, and not afterwards have any injurious consequences; indeed, it will be beneficial in all cases. If there is a continuous exhaustion, a little sal volatile in water (a teaspoonful in a wineglassful) will be useful. It is more rapid in its action than the brandy. If there is not much shock, a little cold water will be better than either brandy or sal volatile. The remedies should be used as soon as they can be obtained; in the meantime, preparation should be made for local treatment. The principle to be aimed at is to cover up the burnt part as quickly as possible from being acted upon by cold air. Sheets of wadding are the best covering, the woolly side being placed next to the burnt part. If there are blisters they should not be interfered with; they should be kept, if possible, from injury, as the serum and detached cuticle is the best covering that the raw surface can have. It protects the cutis until it is capable of protecting itself. If it is necessary to remove the soaked matter, or if suppuration should afterwards be established, then carbolised oil freely applied, and more cotton wadding being again used. If neither wadding nor carbolised oil are at hand, the burnt part may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime water is sometimes applied, but they are inferior to cotton wadding and carbolised oil.

It is astonishing how rapidly burns will heal if the air is kept away, and the blisters are not interfered with, provided the cutis has not been completely destroyed.

As soon as the dressing is completed, and the child is in bed, if the pain continues to be excessive, ten grains of chloral in sugar and water may be given to a child ten years old, provided reaction has taken place. If it is a younger child, a grain may be dropped for each year. The dose may be repeated in two hours if it does not produce refreshing sleep. It is better to give a full dose at once, though some practitioners recommend a smaller dose at shorter intervals. If chloral is not at hand, a few drops of laudanum may be given, a drop for each year, according to the age of the child.

The dressings are not to be interfered with for several days, and in the meantime milk is the best diet, with eggs and beef-tea. Solid food is to be avoided until there is complete recovery, and the wounded parts have cleared from all sloughs. If the mischief has penetrated deeply there will be considerable sloughing, but carbolised oil diminishes the smell which used to come from such injuries before antiseptic dressings were in vogue; these decrease the resulting mischief very materially by excluding the septic germs which abound everywhere. If there is a large granulating wound, it may be treated with slips of lint spread with Turner's cerate (compound calamine ointment), alternating now and then with water-dressing, and sometimes using a solution of sulphate of zinc, soaking a piece of lint the same size as the sore, and placing the wetted lint directly on it. When the granulations are very florid and luxuriant, the parts affected must be kept perfectly quiet and not exercised in any way, by which the tendency to contraction, which so often disfigures the victim, will be diminished.

The longer the first dressings are kept in their place the better. If there is no swelling and no offensive discharge, they should be continued as long as possible and not interfered with; length of time being no argument for removal, if other things do not call for it. The treatment must be regulated according to the part affected. The joints and the parts about the neck are those most liable to be disfigured by contraction. The greatest care is to be taken to avoid unnecessary movement, but whenever a flexure has its opposing surfaces burnt, the opposite sides must be kept apart and the greater care used to prevent adhesions and contractions.

Scalds.—The results are very similar to those produced by fire, and the treatment is of a similar character. We must take care not to drag away the skin with the clothes; cut them away very carefully. In taking off a shirt, or a stocking, or a coat, the skin is very easily brought with it. Blisters must not be broken, and the best protection the cutis can have is the skin which is raised over it by the serum. Instantly envelope the scalded part in wadding, and treat it afterwards with carbolised oil, just as directed for burns, whilst the shock of the pain and the after treatment is precisely similar. The most painful results sometimes follow from accidently taking a draught of boiling water. All that can be done is to get the patient to swallow salad oil, or perhaps the surgeon may find it advisable to perform tracheotomy, that is, to open the throat below the larynx, insert a silver tube and allow the breathing to be continued in that manner until the swelling in the mouth and gullet has subsided. Usually, however, no kind of treatment is satisfactory in its ultimate results, and the patient dies from asphyxia or suffocation.

CORROSIVE ACIDS produce very similar results to those which boiling water sets up in the throat, when they have been accidently or designedly swallowed. *Sulphuric acid* (or oil of vitriol), *hydrochloric acid* (or spirit of salt), *oxalic acid*, *carbolic acid*, *nitric acid*, *corrosive sublimate*, *chloride of zinc*, etc., etc., are the more common poisons which act by destroying those parts of the body with which they come into contact. Chalk, magnesia, lime, mortar scraped from the wall or ceiling of an ordinary room, and mixed with water, and syringed into the mouth or on to the burnt part, are the more easily available antidotes. Corrosive sublimate poisoning is treated best with white of egg and milk; but for the corrosive acids chalk is the best antidote. It must be used as quickly as possible. After all trace of acid has been removed, the part should be kept covered with salad oil, which should be carbolised if the mischief is outside the mouth. Caustic alkalies and their carbonates act somewhat differently to the acids. They do not effervesce when they touch the ground and come in contact with stones and lime compounds, as is the case with the corrosive acids; this result may be used to diagnose the nature of the poison which has been used. The best antidotes for the caustic alkalies are lemon juice or vinegar, afterwards olive oil and milk. The stomach pump is not on any account to be used in such cases, for the passage of the tube would be sure to inflict further injury upon the corroded parts. The nature of the acid is not of much importance, and whether it is potass or soda which has been taken is of no moment; in the one case—that is, acids—chalk, lime, or magnesia, must be given, and in the other—in poisoning by alkalies—vinegar or lemon juice, or any vegetable acid in solution.

DROWNING.

This is a very frequent accident among schoolboys. It may happen to the very best swimmer from various circumstances, although a boy who knows how to swim will be much less liable to the danger. It may be worldly wisdom to adopt the determination of the man who declared he would never go into the water until he knew how to swim, but it is not a pleasant thing to see a fellow-creature in imminent danger of death, and feel oneself utterly unable to assist him because of one's ignorance of the art of swimming. Every boy and girl ought to be able to swim, so that he or she may not feel in after life that they might have saved a fellow-creature's life if their education had been conducted properly. The mode of death varies. It may be caused by drunkenness or by concussion, the head striking against a rock or post in the water; it may be caused by fright, producing syncope or fainting, or an epileptic fit may have preceded the fall into or come on after immersion in the water. There may be paralysis of the muscles of respiration, or some disease of the heart may have given rise to the fatal result; all these conditions may prevent recovery, although the body is taken out of the water very rapidly. The human body has a specific gravity slightly greater than water, so that under ordi-

nary circumstances it sinks to the bottom; but a very little air in the alimentary canal, or a full inspiration counteracts the slight difference between them. An inexperienced person exhausts himself by exertion, whilst the calm and self-confident one is able to keep his head above water for some time. Swimming is easier for a fat person than a thin one, and there is less danger of death from asphyxia or suffocation, which is the way in which death arises when it is caused by immersion.

The treatment to be adopted to recover a drowned person may be based upon five different headings—first, to restore animal heat; and, second, stimulate the heart to recover its lost power; third, to carry on artificial respiration; fourth, excite or renew nerve action; fifth, combat the after consequences which may follow from the immersion. Death is much more rapid in winter than in summer, in consequence of the greater coldness of the water, and water is one of the most rapid abstractors of animal heat from the body. It is necessary, therefore, to get the body as quickly as possible divested of all wet clothes, and have it thoroughly dried. Place it for a few seconds face downwards, with the head lower than the feet, with the mouth open and the tongue drawn forwards; then turn the body on its back—if it can be placed upon a board or a shutter so much the better.

Artificial respiration is carried on best in a combination of what is called the Sylvester method and that which is recommended by Dr. Howard, of U.S.A. Grasp the arms at the elbows and draw them forcibly above the head, having first raised the shoulders by means of the squab of a sofa, pillow, or bolster, or, what is much more likely to be at hand, a bundle of clothes rolled up, so as to raise the front of the chest for about seven or eight inches higher than the hips. Keep the arms on the stretch above the head for three or four seconds, and then reverse the action, pressing the arms against the ribs, by which the breast-bone is raised. Continue this movement about fourteen to sixteen times in the minute. As you raise the arms above the shoulders, an assistant should forcibly press down the sternum or breast-bone, so as to empty out of the lungs as much air as possible, and thus imitate as closely as can be done the action of the respiratory muscles. Whilst this is being performed, not too quickly, others should apply hot flannels, or bricks made hot in the fire, and wrapt up in flannel or other material, so that as much external heat may be applied in as short a time as possible. Do not give up your movements until it is certain that life is absolutely extinct. The effort may be continued for an hour apparently without success, but it may at length succeed. So long as warmth can be kept in the body, the method must not be given up. Be careful not to make the extensions too rapidly; twelve to fourteen times in the minute are more likely to succeed than eighteen or twenty. If there is evidence of life a steady, gentle perseverance will probably be rewarded. If there is a galvanic battery at hand it may be used to promote the contraction of the cardiac muscle; one pole of the battery should be applied to the epigastrium, that is, the space just below the apex of the heart, on the left side. The other should be placed on the nape of the neck, occasionally changing it to the front side just above the collar-bone. It should not be used for more than a minute or two at a time, as it might be hurtful rather than otherwise, if good results did not at once proceed from its application. As soon as respiration is fairly established it is better to leave the patient to himself, provided a proper colour has appeared in the lips and face. A cup of hot tea may be given as soon as the patient can swallow, but the administration of large quantities of brandy-and-water is not to be encouraged. As soon as the patient can swallow it is evident that there is returning vitality, and hot tea will be far better than the more violent stimulant which is usually poured down the unfortunate victim's throat; until the power to swallow has returned it is worse than useless to attempt to give anything. I have seen serious inflammatory action result from a little spirit finding its way into the larynx instead of the gullet. The spasmodic action which this proceeding is likely to excite will be as probably a means for extinguishing a spark of life, by stopping the act of inspiration, as by the contrary effect. Alcoholic stimulants may be useful in cases in which the heart is weak, and a rapid relief is required to remove the livid state which the lips and cheeks exhibit, but if there is a florid freshness, which is usually the case when the sufferer has previously been in good health and is about to recover, tea will be far more satisfactory than brandy. If there is any tendency to hysterical sobbing, a teaspoonful of sal volatile in a glass of water will be the best restorative.

(To be continued.)

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Eminent Practical Teachers.

DAVID STOW,

Founder of the Training System of Education.

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

IV.

IN the sketch of Mr. Stow's career, now completed, there have been indicated certain principles which governed all the methods of the 'Moral Training System,' and gave to the whole a unity which commended its adoption, not only to the intelligence of the educational theorist and philosopher, but also to the 'head and heart' of the social reformer and philanthropist. It may be of advantage to re-state those principles, and briefly to illustrate their application.

The term 'system' is so variously and vaguely employed in reference to education that it may be necessary or at least useful to guard its meaning. Sometimes a certain mode of teaching a particular subject is expressed by this word, and hence Mulhauser's system (writing), Hullah's system (music), the phonic system (reading), the 'intellectual' system (arithmetic), etc. Again, distinctive plans or practices in a school have originated such terms as a 'gallery system,' 'collective system,' 'elliptical system,' 'simultaneous system,' 'circulating system,' 'prize system,' etc. To these the term 'method' would generally be more appropriate, though the nominal adoption of some one or more of them has often given to a school a title to which, in fact, it had no real claim. The introduction of worsted balls and wooden cubes, for example, cannot of itself give a school for infants

the character of a Kinder-Garten. The use of the 'gifts' and 'games' is but a small part of the entire system founded by Fröbel. The spirit of the genuine Kinder-Garten may be entirely absent where all the material appliances are in constant use.

The 'Moral Training System' has often been referred to as the 'gallery system' because of the convenient arrangement of the children in parallel rows on raised seats. Very frequently it was also named the 'simultaneous system' on account of the habit acquired by the children of answering together during lessons given to the 'gallery.' These two features were so prominent and important as to be termed characteristic, but they were only details of the comprehensive system developed by Mr. Stow.

The founder of the 'Moral Training System' always recognised the threefold aspect of the child's nature—body, mind, and soul,—and consequently aimed at providing for its physical, mental, and spiritual necessities. The moral nature he put first in the order of importance. His system was essentially religious. It was based on Bible training. The Bible-stand was a conspicuous piece of furniture in his schools. No 'trainers' were contemplated other than devout, God-fearing men and women, who would conscientiously conduct the daily worship of praise and prayer, reverently expound some Scripture truth, and themselves 'confess' a ready submission in all things to the authority of the revealed Word. By constant instruction in the narratives, doctrines, emblems, etc., of the Scriptures, the children's minds became well furnished with Bible truth. On this truth was established the public opinion of the school, and to this truth appeal was made on all occasions of school discipline, or in the determination of questions of right and wrong. The influence of the Christian teacher predominated, and by the aid of the 'sympathy of numbers,' there was maintained a common sentiment in favour of the right. The tendency of children to lying, stealing, and other evil practices was thus easily checked, and the result was a high standard of practical morality, the happy effects of which have been already described. 'The fear of the Lord is the beginning of wisdom;' and on this foundation was constructed the 'Moral Training System.'

Nothing so much struck the writer on his arrival at the Normal Seminary, Dundas Vale, Glasgow, as the apparent innocence of the two or three hundred infants who were playing among unprotected beds of flowers and fruit without attempting to disturb a single leaf. His eyes seemed to deceive him; such 'results' he had never witnessed—had never conceived to be possible. He entered the schoolroom, heard the song of praise and the simple prayer, and listened to a Bible-lesson (Hosea vi. 4) with utter astonishment at the extensive geographical and other knowledge incidentally shown by the little ones during its progress.

But it was in the lessons 'drawn by the children themselves' from the emblem ('the morning cloud') that he began to see the explanation of the scene previously witnessed in the playground and to understand the secret of such marvellous moral control. Mr. Caughie, the master of this large infant school, was doubtless a superior 'trainer,' but hundreds of his pupils have produced similar results by the Divine blessing on similar means. The lesson on short-lived goodness just referred to was given by a senior student, and was impressed upon the consciences of the children by illustrations drawn from their own experience at home and at school.

At play the principles implanted by the Bible lesson might be exhibited in practice, and every right act helps to form the right habit. Supervision—not espionage—in the playground by 'trainers,' like the 'uncovered schoolroom' itself, was considered to be essential to the system. Any observed fault was, perhaps, referred to at the time of review previous to dismissal, or was used to illustrate the next morning's Bible-lesson. The conscious transgressor would hear his act condemned, perhaps with pity, by his fellows, and would not be likely to repeat it. Rarely was a child arrested for a fault in his play;—never, except in case of danger. When any special evil was committed, the school routine was sometimes suspended in order to a judicial investigation and judgment by the children assembled in the 'gallery.' Thus a valuable sentiment as to the importance of conduct was generated and maintained. The moral results of such constant efforts to implant principles and govern conduct were scarcely credible to those who had not witnessed them.

Corporal punishments *in school* Mr. Stow would not allow. He held that they 'tend to harden or break the spirit.' His idea was that, as in the family, the stimulus should arise 'from a fear of offending rather than from a fear of the rod.' 'Nothing can be more unjust than to punish a boy for a deficiency in the power of calculation, or the memory of words, while he may possess in a high degree reason and imagination—thus stimulating the lower at the expense of the higher powers of the mind.' His own ability and loving nature were such that he could well afford to adhere to the two rules which he lays down: *never strike, never expel.* Teachers of superior character can imitate Mr. Stow's example.

Any practice which could assist in elevating the taste was incorporated in the training system. Not only were the school premises always kept clean and neat, but the walls of the schoolrooms were ornamented with pictures, etc., whilst the shrubs and flowers in the playground created pleasant associations and cultivated a love of nature. The moral effect of such surroundings must not be overlooked.

The theory of educationists is to uphold moral training in our public elementary schools. The introduction of the Revised Code, 1861, which measured the success of schools chiefly by mechanical results tended to confine attention to the three R's, and to merge the distinctive features of all systems into one uniform process. Every minute given to matters not named in the code diminished the chances of success at the annual inspection. The 'tone' of the school was of less importance than formerly, and comparatively few teachers were encouraged to persevere in maintaining their 'moral training' at all risks. The Education Department had early dispirited Mr. Stow by saying that 'no distinctions can be made in your case, whatever influence your institution may have had on the general questions of training schoolmasters, of adding direct moral training, or of introducing a more natural system. We cannot recognise any accomplishments which your students may possess beyond what can be presented to us in writing at this office and the annual examination of our inspectors.' In colleges and in schools alike there has been a *tendency* to overlook practically that which is acknowledged

theoretically to be of the first importance to the individual and to the nation.

'To train is to induce and develop right, physical, intellectual, and moral habits.' The development of moral training into a system was due, as we have seen, to the discovery made by Mr. Stow that the hour's *teaching* in his Sabbath evening class was nearly powerless as compared with the six days' *training* of the streets.

His experience in that Sunday-school also led to a mode of instruction which was novel, interesting, and successful. 'Simplicity is the most distinguishing feature of the training system and the last and highest attainment of a trainer.' This, the first of 152 'hints' published by Mr. Stow, by no means implies, as some wag read it, that the 'trainer' must be a simpleton. On the contrary, the ability to make simple that which is complex is a sign of intellectual vigour and ingenuity. A teacher possessed of this power can so train his pupils that they, too, shall acquire the habit of clear thinking by means of the processes to which their minds are constantly subjected. In the discipline of the mind a few truths clearly defined and firmly fixed by proper processes, are of more value than the acquisition of much knowledge partially perceived or feebly apprehended. 'Let everything pass through the understanding *before* you lodge it in the verbal memory,' was the canon on learning by heart. 'Mechanical memory,' by no means considered entirely useless, was subordinate to true intellectual processes. There was nothing like 'cram' in the methods of the training system.

'Picturing out in words' was considered as a fundamental principle of the system intellectually. Besides the Bible-lesson there were also the so-called secular lessons given by the trainer daily to the 'gallery,' without text-book, and according to certain well-defined principles and methods. The secular lessons might be on any subject; but whether its general construction were analytical or synthetical, it was required that every point should be so clearly 'pictured out,' that in the finished mental picture each part should be distinctly perceived, and in proper harmonious relationship to the whole. All the aid available from objects, pictures, and appliances was insisted upon, but these—valuable as they are—could not alone convey an exact idea, nor secure its proper expression. To the systematic use of objects and prints, first introduced in public education by Pestalozzi, the training system has added the systematic 'picturing out in words' of every abstract term, figurative word or phrase, by analogy, familiar illustrations, etc. 'Every word either represents an object or a combination of objects;' and when the mind is stored with a knowledge of objects, and of words expressive of those objects, it can be readily trained '*from the known to the unknown.*' Figures the most complex may be reduced to simple elements. Perspicuity of language is necessary to clear apprehension, and only by the use of words having a recognised meaning can a teacher give definite ideas to his pupils. Mr. Stow therefore insisted that every new word—or even one employed in a new sense—should be 'pictured out' and its use illustrated by examples until, in its new connection, it was thoroughly understood. The verbal explanation on the part of the teacher or the substitution of a synonym was not allowed; but, to quote the recent instructions to Inspectors, 'the scholar' was 'called on to use it in a sentence of his own.'* The oral lessons—sacred and secular—greatly tended to 'enlarge the learner's vocabulary and make him familiar with the meaning and right use of words,'† and supplied to him the culture not commonly found in the homes of the poor. The secular lessons embraced all that is now cited as *Erdkunde*, and with the younger children this 'knowledge of nature' was not necessarily presented in a 'progressive course.'‡ The whale, ice, a lock, a potato, the robin, wool, a chair, a river, glass, a letter, might form successive topics for gallery lessons for a fortnight in the infant school. Each lesson, complete in itself, would better serve the purposes indicated above than a systematic 'course' on 'animals, plants,' etc. There would be excited a greater variety of interest in the objects by which the little ones are surrounded. Children more advanced are better able to pursue a course of study limited to one branch of elementary science.

In conducting these oral lessons 'questions and ellipses mixed' were used, and hence the system has thus been sometimes called the 'elliptical system.' But unless the word or phrase filled in were the result of thought on the part of the children, the structure of such ellipsis was condemned as mechanical and generally useless. The 'training' process admitted the formation of those ellipses only which had the force of questions.

All or any of the children were allowed to answer simultaneously, except when the trainer thought it desirable to challenge the attention of an individual scholar. Few questions could, in the first instance, be answered by all, but by the re-statement of the fact in a sentence, the order of which was inverted, the whole gallery might fill in the ellipsis: *e.g.*, Who was the father of Isaac? One child may reply, Abraham. The teacher then inverting the order promptly says: Then Abraham was Isaac's . . . . *father;* or, Then Isaac was Abraham's . . . . *son*; or, Yes, the son of Abraham was . . . . *Isaac;* a reply which would be given simultaneously. This very simple example is given to guard any one against accepting the foolish ellipses given in certain books as illustrative of the elliptical method practised at Glasgow.

For the acquisition of the English language, for the general information of the mind, and indeed for the highest culture which any teacher can impart, the oral instruction now referred to is vastly superior to the text-book work so prevalent.

'As people get a worthier and truer perception of the nature of teaching,' says Mr. Fitch, 'oral instruction comes to be more valued.' There is a *habit* of thought induced by the mental processes to which a scholar is subjected from day to day, and the character of the teacher's mind will generally be seen reflected in that of his pupil. Philip of Macedon thanked the gods that there was such a teacher as the philosopher Aristotle in the world when his young son Alexander needed a tutor. The inferior teacher may grind most successfully at the three R's, but the chief ends of education can only be obtained by intercourse with superior minds. 'It is chiefly by means of the living voice that scholars can be really inspired; it is only when the eyes meet, and expression and gestures

* Instructions, No. 18.

† Idem, No. 17.

‡ Code, Schedule II.

are seen, and tones are heard, that there arises that subtle and indefinable sympathy between teacher and taught which is so essential to the life of the scholar. Then only can there be that adaptation of the matter to his wants: the light glancing over unimportant details, the rest and repetition over the more significant facts, the pause after what is exceptionally difficult, the happy illustration, the *argumentum ad hominem*, the brisk and pointed question by which the teacher assures himself that he is being followed and understood.' High 'per-centages' may be secured by well-arranged mechanical instruction from text-books, but the vigour of the superior mind in effective oral instruction imparts power, and genuine gallery lessons conducted on the training system were simply invaluable as a means of culture as well as of instruction.

The general intelligence thus developed in schools a quarter of a century since was considerable, but after the introduction of the code in 1861, the 'passes' were of first importance, and hence there has arisen a strong temptation to omit all lessons the 'results' of which could not be of immediate financial advantage.

The most 'simple' teachers are the best teachers, and a successful training lesson in the infant school was, according to Mr. Stow's maxim just quoted, a proof of high attainment. All students at Glasgow—men as well as women—practised in the 'Initiatory Department.' Good 'infant trainers' were highly esteemed, and, even economically considered, it was held to be an advantage to have the most efficient teachers in infant schools. With the intelligence early awakened, more rapid progress in after-studies is assured.

Oral instruction is the 'great vitalizing instrument in education,' and the gallery lesson under Mr. Stow's method was always, to teacher and scholars alike, an intellectual pleasure. Let us hope that no 'pressure' will ever cause its entire disappearance from our schools.

(To be continued.)

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

Joint Author of 'The Field Naturalist's Handbook.

No. XXII.—THE MARSUPIALS.

IT is a strange fact that all the indigenous mammals of Australasia belong to a group which possesses but a single representative in America and one in Malacca. Many zoologists have endeavoured to account for this fact, but can only do so by supposing that these remarkable creatures are the result of a later creation than that by which the remainder of the globe received its mammalian inhabitants. Others take precisely the opposite view of the problem, as we shall presently see.

To this mysterious group has been applied the title of Marsupials, a word signifying 'pouched,' and derived from the Latin *marsupium, i.e.*, a purse or pouch. The reason for this appellation we find in the structure of the female animal, which is furnished with a very curious organ for the reception of her young after birth.

This consists of a large pouch in the lower part of the abdomen, in the interior of which are placed the teats. As soon as the young are born, they are transferred to this pouch, and at once attach themselves to the teats, where they hang until they have increased in size to a considerable degree. As they grow older and stronger, they leave their protecting shelter, at first for a short time only, but gradually for longer and longer periods. Should danger approach, however, they immediately return to their cradle, where they remain until all cause of alarm has passed away.

In order to prevent the strain upon the walls of the abdomen, which would necessarily result were the pouch entirely unsupported, two supplementary bones, called the marsupial bones, proceed from the pelvis and run almost parallel with the spine. They are attached at one end to the pelvis, or hip bone, and are directed rather forwards and outwards. These auxiliary bones serve not only to sustain the weight of the pouch, but also, as is thought, to aid in compressing the various glands which afford nourishment to the young.

We will treat this subject in greater detail when we come to the kangaroo.

Although this pouch is present in all the marsupial animals, it is developed to a far greater degree in some than in others. In the kangaroo, for instance, it is of very large comparative size, while in others, such as the Myrmecobius, it is little more than rudimentary, and is quite useless for the reception of the young.

We may, perhaps, wonder why any of the marsupials should require, during their infancy, a refuge with which the animals of no other order have been provided. But the reason for this we may easily see by taking into consideration the wonderfully small size of the young when they first come into the world. Take the kangaroo, for instance. Here we have an animal, which, when full grown, attains to a length of seven feet six inches from the nose to the tip of the tail. Yet, when first born, this same creature is barely an inch in total length, and is, of course, entirely unfit to begin life in the ordinary manner.

It is a somewhat singular fact that many of the marsupials seem to be in their own land representatives, so to speak, of widely-different animals inhabiting other parts of the world. Thus the Tasmanian 'wolf' strongly resembles, both in habits and appearance, the veritable wolves which are found in many parts of the world; the kangaroos represent the Jerboas, the Petaurists take the place of the squirrels, and so on.

As yet, our knowledge of the marsupials, or *macropidæ*, as they are indifferently termed, cannot but be considered as very incomplete. Several species have been introduced into our list upon the authority of a single specimen only, while many gaps exist which have yet to be filled up.

It is, to say the least, probable, however, that a large number of marsupial animals have yet to be discovered, and that when the vast unexplored districts of Australia have been traversed we may add greatly to our knowledge both of those species which are already known to science, and also of many others of whose very existence we are as yet unaware. Recent geological discoveries, also, would seem to show that a large field wherein to labour is open before us in this branch of natural science, for the fossil remains of

many animals have been met with which, although clearly members of the marsupial group, would yet appear to have belonged to genera which seem to be now extinct. Whether this is really the case or not, however, we cannot satisfactorily determine until future explorations shall have supplied us with a more complete account of the life and habits of those *macropidæ* already known to us, and also furnished us with some little idea of the real dimensions of the group.

The systematic arrangement of these animals is exceedingly difficult, and at present we can only accept any system as provisional. The animals are so bizarre, so contradictory, if we may use such a term, that zoologists feel themselves quite at a loss to fix upon any definite characteristics on which to base their systems.

In some parts of their structure they resemble the reptilian types, while in others they approach the birds, and seem to form a connecting link between them and the mammals. Objection has been made to the use of the word Marsupials, and for this reason. The marsupium is nothing but a fold of skin, turned over so as to cover the teats, and, as we have seen, it is in some species so small as scarcely to be perceptible, while in others it can hardly be said to exist at all. It is thought, therefore, that this fold of skin is not of sufficient importance to be accepted as the basis of a system.

Another term, Ovovivipara, has been suggested, and certainly is more appropriate, though more cumbrous than the word marsupiata.

As for their separation into groups, Professor Owen bases his system upon the food which they eat. In order to procure that food, they are gifted with various modifications of structure. Some can leap like the jerboas of the Old World, and possess similarly formed legs. Some can climb trees as actively as any of the monkey tribe, many of them possessing tails as prehensile as those of the American spider monkeys. Some can swim as well as the otter, while others can dig holes in the ground like the badger, or sweep through the air like the flying squirrels.

Bearing these facts in mind, Professor Owen divides them into five groups. First come the Sarcophaga, or flesh-eaters. Then come the Entomophaga, or insect-eaters. Next come the Carpophaga, or fruit-eaters; then the Poëphaga, or flock-eaters (flock of sheep); and lastly, the Rhizopoda, or root-eaters.

This is, doubtless, an approach to a perfect system, but it is not so well adapted for the simple identification of species as that of Dr. Gray. I shall therefore follow the latter system. According to this arrangement, the Marsupials are divided into several families, the first of which is scientifically known as the *Phalangistines*, on account of the structure of the hinder feet, two of the toes of which are united as far as the 'phalanges.' The members of this family are chiefly arboreal in their habits, and their feet are consequently armed with sharp curved claws, and endowed with considerable powers of grasp, in order to adapt them as far as possible to the manner of their existence.

The *Phalangistines* are again divided into three smaller groups, which are considered by some authors merely as genera. These are:—firstly, the Petaurists, in which the skin of the flanks is developed in a manner very similar to that which has already been described with regard to the Colugo, or Flying Lemur, in the article upon the monkey tribe; secondly, the Phalangists, which are provided with a long and prehensile tail, but in which the skin of the flanks is not developed, as in the Petaurists; and thirdly, the Koalas, in which both the skin-extension and the tail are altogether wanting.

First upon the list of the *Phalangistines* is the pretty little Opossum Mouse, or Pigmy Petaurist (*Acrobates pygmæus*), so called on account of its minute size.

When full-grown this little creature is barely six inches in length from the nose to the tip of the tail, and bears, when at rest, so great a resemblance to the common mouse of our own country, that it might be easily taken for that animal by an observer unacquainted with the peculiarities of its formation.

While not in active motion, the parachute-like extension of the skin of the flanks lies so closely to the body as to be scarcely visible, the animal seeming to have nothing in any way remarkable with regard to its structure. But no sooner does it move than the skin-development becomes apparent, reminding one very strongly of the colugo which has been already mentioned.

The method adopted by the opossum mouse, too, in passing from tree to tree, is very much the same as in that animal. Stretching out the limbs as far as possible, the little creature launches itself boldly into the air, passing over considerable distances by the aid of the primary impetus alone, and possessing some little power of altering its course at will. When the first impulse is exhausted, however, the flight can no longer be continued, and a fresh leap must be taken from some convenient spot before the animal can make further progress through the air.

But so well does the little creature calculate the power of its spring, and also the exact distance of the spot to which it directs its flight, that it is able to travel for considerable distances with scarcely a break in its course, each leap or flight landing it upon a tree or other object from which a second spring can be immediately taken.

The food of the opossum mouse, in common with that of the other Petaurists, is chiefly of a vegetable nature, consisting chiefly of leaves, fruits, and buds. The structure of its teeth, however, which bear a considerable resemblance to those of insectivorous animals, would lead us to suppose that its diet is occasionally varied by the admixture of animal food.

The opossum mouse is a pretty little creature, more especially when at rest, for the folds in which the parachute-like skin then falls, cause a portion of the white fur of the lower parts of the body to alternate with the darker hues of the upper surface, thus causing a variegated appearance, which has a very pretty effect. The animal is very common at Port Jackson.

The well-known Sugar Squirrel, or Squirrel Petaurus (*Petaurus sciureus*) bears a wonderfully close resemblance to the true Flying Squirrels of other parts of the world, of which it would seem to be the Australian representative.

Unfortunately, all the petaurists are nocturnal animals, concealing themselves in hollow trees, etc., during the hours of daylight, and only issuing from their retreats after darkness has fairly set in. Consequently, our knowledge of their habits while in a state of nature is very imperfect, and although they have often been captured and brought over to this country, the unaccustomed confinement influences them to such

a degree that we can learn very little concerning their true mode of life from their proceedings while in a state of captivity. So it is with all wild animals, whose nature becomes entirely altered when they exchange the wild freedom of their natural existence for the narrow boundaries of a cage.

The powers of flight, if we may so call it, of the sugar squirrel, are very remarkable, the animal being able to pass for a very considerable distance through the air without any perceptible effort. Mr. Bennett tells us that he has known one of these creatures to leap fairly across a river forty yards in width, commencing its flight, too, at an altitude of only thirty feet.

In order to assist these animals in their arboreal evolutions, the hinder feet are formed in somewhat the same manner as is the case with the quadrumana, the thumb being opposite to the fingers, so that small branches, etc., can be grasped with considerable power. The long and curved claws also greatly assist the animal when ascending a perpendicular trunk, as they can be inserted into the smallest crevices, and so afford a firm foothold, but for which the squirrel would be quite unable to scale the tree.

The sugar squirrel is not a very large animal, being about sixteen inches in total length, of which the tail occupies just one half. It is a pretty little creature, the fur being of a very delicate brownish-grey, with the exception of a dark stripe which runs from the nose to the root of the tail, and a similar one which borders the parachute membrane. The lower parts of the body are almost white, as is also the lower surface of the long and bushy tail.

PASSING to the Phalangists, we find that the Spotted Cuscus (*Cuscus maculatus*) is one of the first upon the list.

In the animals of this group the tail, which possesses considerable prehensile power, is not covered with bushy hair, as in the preceding animals, but is entirely naked, with the exception of a small portion at the base.

The spotted cuscus is by no means a small animal, as an ordinary specimen will attain to some three feet in total length.

Although the cuscus spends almost the whole of its existence among the branches of trees, it is by no means as quick and agile in its movements as are the petaurists. Instead of the bright activity which characterises the preceding animals, it is distinguished by slow and cautious movements, seeming never to consider itself in perfect safety unless the tail is tightly coiled round some convenient branch.

The prehensile power of this organ is very remarkable, for the animal is able to hang suspended from a branch by its aid alone for a very considerable time. Should it detect the approach of danger, it usually resorts to a pendent position, remaining suspended until it considers itself once more in safety. While thus hanging it so closely resembles a large bunch of fruit as to deceive any but a careful observer.

The spotted cuscus is a pretty animal, the ground colour of the fur being whitish-grey, irregularly sprinkled with spots, or rather blotches of a deep rich brown. These markings vary very much in different individuals, some being very much darker than others, while the number, size, and colour of the dark spots is very uncertain.

Ill at ease as it appears among the branches of trees, at least when compared with the agile and sure-footed petaurists, the cuscus yet appears but seldom to visit the ground, only doing so when compelled by necessity. Like the preceding animals, it feeds chiefly upon fruit, buds, and leaves, occasionally varying its diet, however, with insects and other small creatures.

SEEMING, both in form and nature, to be the Australian representative of the fox, the Vulpine Phalangist (*Phalangista vulpina*) fully deserves its title. In its native land it is more commonly known as the Vulpine Opossum, or Native Fox.

Nocturnal in its habits, as are all the other members of the group to which it belongs, our knowledge of its mode of life is as yet very imperfect. Being, however, a very plentiful animal, and one which is spread over a wide extent of country, we are, nevertheless, better acquainted with its habits than with those of most of its congeners.

The Vulpine Phalangist appears to be far more fond of animal food than are those members of the group which have already been described, devouring young birds, etc., with great apparent relish. The fore-paws are peculiarly adapted for the manipulation of living prey, being gifted with considerable strength, and also with great mobility, so that they can be employed with almost as much freedom and address as can those of the common British squirrel.

On account of the beauty and the fine quality of its fur, this animal is subjected to considerable persecutions both by natives and settlers, great numbers being annually slain for the purpose of obtaining their skins. The natives use them largely in the manufacture of the rather scanty clothing to which they are addicted, while civilized nations utilize them for many and various purposes. The flesh, also, is considered to be very good, and is much esteemed by the Australian natives, who, like savages in general, never seem to consider that they have eaten enough, and will eagerly pursue one of these 'opossums' immediately after a heavy meal with as much zest and eagerness as if they had not seen food for days.

The vulpine phalangist is a rather smaller animal than the spotted cuscus, seeming but seldom to exceed two feet six inches in total length, of which the tail occupies about two-fifths. The colour of the fur is a greyish brown, generally more or less tinted with a reddish hue. The tip of the tail, which is very thick and bushy, is always black.

NEXT we come to the quaint-looking Koala, or native monkey, or Australian bear as it is more commonly termed (*Phascolarctos cinereus*), which has really some pretensions to the latter of its popular titles. For there is indeed something very ursine in the general aspect of the little creature, which has been likened to the sun-bears of the Indian Archipelago.

The koala is by no means an abundant animal, even in the limited districts which it inhabits. It seems to be entirely confined to the south-eastern parts of Australia, and is so far from common that specimens are only occasionally met with.

The koala is arboreal in its habits, but is very slow and deliberate in all its movements, making very sure of its foothold before trusting itself to take a step. The feet are formed in a very curious manner, the toes being divided into two sets, so to speak, the one

composed of the two inner toes, and the other of the three outer. This structure, however, although of great service to the animal when travelling along the branches of trees, is very much the reverse when it attempts to walk upon a level surface, causing its progress to be of a particularly slow and cautious nature.

The nature of the koala is remarkably gentle, the animal allowing itself to be taken captive without attempting more than the very slightest resistance, and scarcely ever making any attempt to escape. It is liable, however, to sudden fits of passion, during which it becomes very much excited, and utters a number of sharp and fierce yells.

The appearance of the koala is rather remarkable, owing chiefly to the long tufts of white hair which fringe the ears. The general hue of the fur is a delicate grey, slightly tinged with a reddish hue in the adult animal. Its size is not very great, the total length being about two feet, while the height at the shoulder is about ten inches.

Like many other Australian animals, the koala is easily tamed, and is often to be seen as a pet in the houses of sheep-farmers. It has, however, no claims to intellect, and, indeed, all the Australian mammals are deficient in this respect.

In proportion to the size of the body, the brain is very small, and partakes of the reptilian type. The mammals of the Old World have the two hemispheres of the brain large enough to embrace the olfactory lobes, the optic lobes, and the cerebellum, or lesser brain. But in the Marsupials the hemispheres, on which depend the intellectual powers, are so small that the olfactory lobes project in front of them like a brain in miniature, the optic lobes are quite exposed behind them, and behind the optic lobes comes the cerebellum.

Any great development of intellect, therefore, cannot be expected from animals in which the brain, which is the organ of intellect, is so imperfectly developed.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

IN most cases, how much easier would the work of a teacher of science be if, on the particular point he wishes to make clear, the minds of his pupils were, to begin with, absolutely blank. I often wish, when I am about to explain something, that the boys had really never heard anything of it before; that the ground I am about to cultivate was, in fact, virgin soil. This, however, is seldom the case with grown-up people, and not always with children. I often find they have read or heard something about the subject, and that *something* not quite true. Hence it is that the reader of these outlines of lessons may sometimes think I am making an unnecessary digression. But I feel that my business is not only to bring to life new truths, but occasionally to kill off old errors.

The following is the outline of the second lesson on 'Liquid Displacement.'

'Open your exercise book, Jones, and read the fact we proved in our last lesson.' Jones reads—'A body immersed in water, displaces its own bulk of the liquid.' Very well. Now I have here a little cube of polished wood hanging by a fine wire, like the cube of lead in the last lesson, and the same glass jug of water. (Adams, holding up his hand.) Well, Adams, what is it? Ans.—My father says that's not true. What is not true? Ans.—The sentence we have written in our books: that Jones has just read. Indeed! Does he? Ans.—Yes, sir. He cut out a little cube of loaf sugar, tied a wire round it, and let it down in a tumbler of water, and it didn't displace any; the sugar all went away. (Several boys in the class laugh at Adams.) Stop, boys! Don't laugh. His father is quite right. The sugar does *not* displace the water. Adams, my boy, you are very fortunate in having such a good father: one who talks with you about these things and tries to set you right. What *he* says about the sugar is true, but what Jones has read is true also. Next Wednesday our object-lesson is about 'solutions,' and if you will ask your father to cut out a little cube of loaf sugar or salt, tie a wire round it, and let you bring it to me, I will make the whole thing clear to you. Tell your father I thank him very much for his message. Now we will go on. I dip this cube of wood in the water, you see it does not sink like the lead; it floats. I force it to the bottom of the jug; it quickly rises again and floats. (Several boys raising their hands, wishing to speak.) Well, Smith? Ans.—That's because the wood is lighter than the lead. What do you say, Jones? Ans.—It rises because the wood is lighter than the water; a piece of cork would rise quicker still. Do *you* think the same, Cox? Ans.—Yes, sir; a balloon rises in the air for the same reason: the balloon is lighter than the air. Very well, let us inquire a little about this. Turn back a few pages in your exercise books, to the lesson upon 'force.' If we see any portion of matter in motion, what is it we know must have been exerted? Ans.—Force. Just so. Now, when this cube of wood was rising in the water, and when a balloon rises in the air, we certainly have matter in motion. Force, therefore, must be exerted to cause that motion. Now where is the force? No answer? Look again. I hold this piece of wood at the bottom of this water; now I let go, it is rising. What is the force that makes it rise? Ans.—It rises because of its lightness. Indeed! Is lightness a force? (A boy raising his hand.) Well? It is the water that forces the wood up. How can the water force the wood up? Ans.—It is trying to get under it. And does that make the wood rise? Ans.—Yes, sir. Very well, look, I will let the cube of lead down in the water; does the water try to get under that? Ans.—Yes, sir. Then why does the lead not rise? (a few minutes' interval, during which all in the class are thinking. A few boys raise their hands). Well Robinson? Ans.—I can see how it is. The water that the cube of wood displaces is trying to get back again, and so pushes the wood up; and the water that the lead displaces is trying to push the lead up, but it's too heavy to go up. (A boy, Hawkins, looking very eager to speak). Well, Frank? Ans.—I know why it is. A cubic inch of water weighs more than a cubic inch of wood, so the water pushes the wood out of the way, and it goes up;

but a cubic inch of lead weighs more than a cubic inch of water, so it pushes the water out of the way and goes down. (A boy, Hawell.) Please, sir, we have had all this before. When? Ans.—When we had some lessons on specific gravity. What Hawkins says is only the same thing as saying that the specific gravity of wood is less than that of water, so the wood rises and floats, but the specific gravity of lead is greater than that of water, so it sinks. (A boy, Smith). Then what I said at first is true, the wood rises and floats because it is lighter than water, and the lead sinks because it is heavier. (Another boy). *I* should say the wood rises not because of the lightness of the wood, but because of the heaviness of the water. (Another boy.) That's just what I was going to say; it is the gravity of the water makes the wood rise. Now if that is the case, Cox, what would you say makes the balloon rise? Ans.—The gravity of the air. Exactly so, Cox; now, boys, we have spent a long time over this; but the point I wanted you to see was this, that to say the wood or the cork rises because they are light, is really no reason at all. The true reason is the gravity of the water.

Now look, this piece of wood is floating; has it gravity? Ans.—Yes. Very well; it has a tendency to fall to the bottom of the jug. What prevents its falling? Ans.—The gravity of the water. Good, Drayson. The gravity of which water? Ans.—Of the water in the jug. Do you mean of the whole of it? No answer. How much of the water is trying to get into the place occupied by the wood. Ans.—That which the wood has displaced. Then which is the water whose gravity keeps the wood floating? Ans.—The gravity of that which is displaced. Now tell me what gravity depends upon? Ans.—Mass. And what is a measure of mass? Ans.—Weight. The weight of this piece of wood is just one ounce. Therefore, what must be the weight of the water which this floating wood displaces? Ans.—One ounce. Very good. We are, therefore, just beginning to see the fact, that a floating body displaces its own weight of the liquid. Next lesson we will follow this up, with a good many illustrations.

(To be continued.)

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

(1) Arranged in column on the blackboard—6897 + 4658 + 7963 + 5876. Ans. 25,394.

(2) Dictated—from two thousand and thirteen take nine hundred and seven. Ans. 1106.

(3) Dictated—Add together six hundred and thirty, nineteen, seven hundred and five, and one thousand. Ans. 2354.

STANDARD II.—(*all dictated*).

(1) From twelve thousand and thirteen take nine thousand two hundred and eleven. Ans. 2802.

(2) Divide three million and ten by eight. Ans. 375,001—2.

(3) Multiply thirty-two thousand nine hundred and eleven by five hundred and eighty. Ans. 19,088,380.

(4) I have 300 apples and 98 are bad ones. How many good ones have I? Ans. 202.

STANDARD III.

(1) Add together the five following sums of money:—Seven thousand and eighty pounds ten shillings and eight pence farthing, eight hundred and nine pounds nineteen shillings and eleven pence, seventy-six pounds and eight pence half-penny, twenty-nine thousand three hundred and eight pounds eight shillings and three farthings, seven thousand and ten pounds seventeen shillings and seven pence. Ans. £44,285 16s. 11¼d.

(2) A boy obtained a prize of £16 on leaving school. He spent £3 15s. 6d. for clothing, and £1 17s. 8d. for books. How much had he left to put into the savings' bank? Ans. £10 6s. 10d.

(3) Take nine hundred and nine pounds seven shillings and eleven pence, from ten thousand and ten pounds ten shillings and ten pence farthing. Ans. £9,101 2s. 11¼d.

(4) Divide four hundred and eighty-two thousand one hundred and forty-two by one hundred and seven. Ans. 4,506.

STANDARD IV.

(1) (*a*) Reduce 23 half-sovereigns to farthings. Ans. 11,040.

(*b*) How many acres in ten thousand and ten square rods? Ans. 62 ac. 2rd. 10 sq. rods (or perches).

(2) How much would seven hundred times nine shillings and three farthings be? Ans. £317 3s. 9d.

(3) Divide nineteen thousand three hundred and twenty-three pounds ten shillings and elevenpence farthing by sixty-three. Ans. £306 14s. 5¼d.—3.

(4) Multiply seven hundred and nine pounds and elevenpence half-penny, by one hundred and four. Ans. £73,740 19s. 8d.

STANDARD V.

(1) If a family spends £1 15s. 11¼d. for bread when it is 5¾d. per loaf, what will they spend in the same time when the loaf cost 6½d.? Ans. £2 0s. 7½d.

(2) A builder employs 35 bricklayers and 15 carpenters for 23 weeks, giving each bricklayer 25s. a week, and each carpenter 2s. 6d. more than each bricklayer. What will he pay them altogether, supposing each man to lose 1s. per week for loss of time? Ans. £1423 2s. 6d.

(3)

	£	s.	d.
2 dozen screws at 3½d. each =	0	7	0
14 bolts at 5s. 9d. per doz. =	0	6	8½
24 locks at 13s. 6d. each =	16	4	0
21 brass rings at 3 for 2d. =	0	1	2
17 lbs. of nails at 1d. per oz. =	1	2	8
3½ gals. of oil at 11d. per gal. =	0	3	2½
Ans.	18	4	9

(4) Find by practice the cost of 12,019 articles at £17 3s. 9½d. each. Ans. £206,601 12s. 0½d.

(5)

	£	s.	d.
14 yards of alpaca at 8½d. per yard =	0	9	11
6 dozen buttons at ¾d. each =	0	4	6
17 yards of calico at 5½d. per yard =	0	7	9½
7 prs. of blankets at 15s. 8d. per pr. =	5	9	8
20½ yards of silk at 5s. per yard =	5	2	6
9 neckties at 3s. 8d. each =	1	13	0
Ans.	13	7	4½

STANDARD VI.

(1) Find the value of $\frac{1}{3} + 2\frac{1}{2} + 4\frac{3}{4} + 1\frac{5}{16} + \frac{3}{4}$ of $3\frac{1}{2}$ of $\frac{1}{3}$.
Ans. $8\frac{31}{48}$.

(2) After spending $\frac{5}{16}$ of my money, I have 7s. $0\frac{1}{2}$d. left. How much had I at first? Ans. 9s. 9d.

(3) Add together ·75 of 20s., ·75 of a guinea, ¼ of a crown, and ·125 of 24s. Ans. £1 15s. 0d.

(4) Find by practice, the value of 36 cwt. 2 qrs. 14 lbs. of spice at £7 11s. 6d. per cwt.
Ans. £277 8s. $8\frac{1}{4}$d.

(5) If a man can walk a certain distance in 1 hr. 18 min. 45 sec. by taking 76 steps in a minute, how many steps per minute must he take in order to walk the same distance in 1 hr. 3 min.? Ans. 95 steps.

(6) Find the value of $1\frac{3}{11} - \frac{4}{7}$ and of $1\frac{2}{11} \div \frac{4}{7}$, and reduce each answer to a decimal.
Ans. ·70129 + ; 2·2̇2̇7̇.

Dictation.

STANDARD I. (BOYS).

Where are the boys with their books?
Table, Chair, Work, Bread, Father, Mother.

STANDARD II.

A. It is there chiefly that the tiger has his haunts. There by day as well as by night he is on the watch for his prey. The skin of the tiger is covered all over with beautiful black stripes.

B. It is more afraid of him than they are of the lion. The lion is content with enough to satisfy his hunger, but the tiger is never satisfied.

STANDARD III.

They were watched so closely and kept so hard at work, that this was very difficult indeed. But any fate would be better than bondage; and the difficulties they met with only made them more determined to succeed. Their plan was, to make a boat in separate parts.

STANDARD IV.

Besides trying to defraud him, the rival manufacturers did their best to discountenance the use of the yarns he made, although they were much superior to those made by them. He retaliated by working up his own yarn into stockings and calicoes, which became a very profitable business. For the first five years his mills yielded little or no profit; but after that, the adverse tide against which he had struggled so bravely turned.

Grammar.

STANDARD III.

Write out all the nouns, pronouns, adjectives, verbs, and adverbs to be found in your Dictation.

Composition.

STANDARD V.

Write from memory the substance of this passage read to you twice:—

A great many years ago, when barbarity in Egypt was even more excessive than it is at present, a certain pasha was in the habit of daily inspecting his men in the barracks. One day a milkwoman (who generally supplied the milk), came to him and complained of a man having drunk all her milk. He grew in a rage and said, 'Are you sure?' 'Yes,' said the woman, 'quite sure.' In a few minutes the man was brought to him and his head was struck off. The woman was horrified, and was more so when the pasha had the stomach of the man opened, for there was her milk. The pasha thereupon handed her the money for the milk, and remarked—'You may go now, my good woman; but if I had not found the milk there, I should have had your head as well.'

STANDARD VI.

What occupation would you like to follow when your school days are over? Give reasons for your preference.

Physical Geography.

FIRST YEAR'S COURSE.

(1) Water falls as rain, snow, and hail. Explain how this is.

(2) What is a watershed? Name the principal watersheds in the North of England, and a river-basin on each side of it.

(3) What is the wind? Give the names of winds according to their respective rates of speed.

(4) Explain how water, which falls as rain, again falls in a similar manner.

(5) Why do we not see the steam which comes out of a kettle-spout until it is a little way from the mouth?

Domestic Economy.

FIRST YEAR'S COURSE.

First Branch.

(1) How would you wash flannels?

(2) Name the utensils which a washerwoman uses

(3) Give directions for folding and ironing clothes.

(4) How do you wash coloured clothes?

(5) What part of the body should be most protected from changes of weather?

Second Branch.

(1) What does the nutritive value of cheese consist of?

(2) Will a child be healthy if fed on starch-food only. Why?

(3) Give the composition of a potato.

(4) Name the different kinds of sugar sold, and state from what vegetables obtained.

(5) How do we obtain 'dripping'? What kind of food is it?

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR' FOR DECEMBER, 1882.

STANDARD IV.

A. 1. 3,024,000 sec.
2. £1615 6s. 3$\frac{3}{8}$d.
3. £536 17s. 6$\frac{4}{5}$d.—1.
B. 1. 56h. 13min. 53s.
2. £57,442 12s. 3d.
3. £863 13s. 2$\frac{1}{4}$d.—51.
C. 1. 120 score oranges.
2. 131lb. 11oz. 16dwt. 7gr.
3. £8 8s. 8$\frac{9}{4}$d.—3779.
D. 1. 4s. 7$\frac{1}{2}$d.
2. 4s. 10$\frac{1}{2}$d.
3. £8598 4s. 4d.

E. 1. 118 coats; 1 yd. 3 qr. left
2. 209,952 c. in.
3. 1s. 8$\frac{3}{4}$d.—4734.
F. 1. £81 15s. h., £27 5s. car.
2. 213,444 sq. ft.
3. £80,532 11s. 7$\frac{1}{2}$d.

ADVANCED EXAMINATION.

1. March 18th, at 3.28 p.m.
2. 76 ton 3 cwt. 1 qr. 6 lb.
3. 276 oranges.

STANDARD V.

A. 1. £106 7s. 8$\frac{1}{2}$d.
2. £269 10s.
3. £1 14s. 1$\frac{1}{2}$d.
B. 1. £4 18s. 5$\frac{1}{4}$d.
2. £1968 9s. 7$\frac{1}{2}$d.
3. £3 11s. 3d.
C. 1. £27,344 4s. 11d.
2. £165 14s. 10$\frac{3}{4}$d.
3. £44 6s. 4d.
D. 1. 20 to 21.
2. £46,085 7s. 9$\frac{3}{4}$d.
3. 18s.

E. 1. £492 3s. 9d.
2. £130 19s. 11$\frac{1}{2}$d.
3. 4 days.
F. 1. Nov. 9th, at 11.20 p.m.
2. £105 7s. 10$\frac{1}{2}$d.
3. 18s. 3$\frac{1}{2}$d.

ADVANCED EXAMINATION.

1. £37,287 6s. 11$\frac{5}{8}$d.
2. £65 13s. 7$\frac{5}{8}$d.
3. £26 12s. 4$\frac{3}{44}$d.

STANDARD VI.

A. 1. 3.
2. $\frac{1}{3}$.
3. $4\frac{1}{11}$.
B. 1. 2·1922.
2. £1 11s. 5$\frac{5}{8}$d.
3. $\frac{1}{28}$.
C. 1. 900 shirts.
2. $1\frac{9}{10}$.
3. 6s. 7$\frac{3}{8}$d.
D. 1. A to B, as 55 to 63.
2. £50 7s. 10$\frac{7}{8}$d.
3. $\frac{1}{32}$.

E. 1. $21\frac{3}{9}$.
2. 10719lb.
3. $1\frac{3}{10}$.
F. 1. ·000053138.
2. £20 19s. 9$\frac{7}{8}$d.
3. 3 to 16.

ADVANCED EXAMINATION.

1. $24\frac{8}{13}$.
2. $1\frac{9}{11}$.
3. ·0060007+

STANDARD VII.

A. 1. £18 5s.
2. £104 14s.
3. $3\frac{7}{8}$ per cent.
B. 1. $3\frac{1}{2}$ per cent.
2. £149 1s. 3d.
3. £5 9s. 7$\frac{9}{8}$d.
C. 1. £470 6s. 3d.
2. 110 per cent.
3. $8\frac{8}{1}$ years.
D. 1. 9s. 5$\frac{1}{2}$d.
2. 3s. 6d. in the £.
3. £666 13s. 4d.

E. 1. £569 0s. 0$\frac{3}{4}$d.
2. 17s. 7$\frac{1}{2}$d.
3. £8 10s. 2$\frac{1}{2}$d.
F. 1. 4s. 9d. and 2s. 9d.
2. £651 8s. 7$\frac{1}{2}$d.
3. 150 pears.

ADVANCED EXAMINATION.

1. £1104 1s. 7·392768d
2. £78.
3. $2\frac{1}{10}$lb.

SOLUTIONS TO THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR' FOR DECEMBER, 1882.

STANDARD IV.

1. 285,407 m. = 198 d. 4 hrs. 47 m. From the beginning of April to Oct. 2nd at 8.15 p.m. is 184 d. 20 h. 15 m., and leaves 13 d. 8 h. 32 m. to be reckoned backward from the end of March, giving March 18th, at 3.28 p.m. Ans.

2. 76 c. yd. 16 c. ft. = 2068 c. ft. = (×82½) 170,610 lb. = 76 ton 3 cwt. 1 qr. 6 lb. Ans.

3. 4 for 2½d. = 7½d. a doz., hence 7½d. − 3½d. = 4d. gain on a doz. 7s. 8d. ÷ 4d. = 23 doz. = 276 oranges. Ans.

STANDARD V.

1.

	£	s.	d.			
2 r. is ½	48	17	6			
		10				
	488	15	0	value of	10 ac.	
		10				
	4887	10	0	,,	100 ,,	
		7				
	34,212	10	0	,,	700 ,,	
	2932	10	0	,,	60 ,,	
	97	15	0	,,	2 ,,	
1 r. is ½	24	8	9	,,		2 r.
20 p. is ½	12	4	4½	,,		1 ,,
5 p. is ¼	6	2	2¼	,,		20 p.
1 p. is ⅕	1	10	$6\frac{0}{11}$	,,		5 ,,
	0	6	$1\frac{1}{11}$	,,		1 ,,
Ans.	£37.287	6	11½	,,	762 a. 3 r.	26 p.

2. 102,150 sq. in. = 78 sq. yd. 7 ft. 54 in., which at 16s. 8d. a yd. = £65 13s. 7$\frac{5}{8}$d. Ans.

3. Bringing both the weights to lbs. we have 1504 lb. and 91,504 lb. respectively. Then (8s. 9d. × 91504) ÷ 1504 = £26 12s. 4$\frac{3}{44}$d. Ans.

STANDARD VI.

1. $17\frac{3}{8} - 11\frac{7}{20} = 6\frac{3}{40}$. $(14\frac{3}{8} \div 56\frac{1}{4}) = (\frac{7}{8} \times \frac{4}{225}) = \frac{7}{450}$. $(6\frac{3}{8} \div \frac{441}{450}) = (\frac{51}{8} \times \frac{450}{441}) = (\frac{6}{1} \times \frac{450}{49}) = 1\frac{2}{7}\frac{5}{4}\frac{0}{9} = 2\frac{4}{4}\frac{2}{9}$. Ans.

2. Bringing both the terms of money to crowns, we find that the result must be $\frac{4}{5}\frac{8}{4}\frac{5}{6}$ of $\frac{1}{4} = 1\frac{9}{1}\frac{7}{1}\frac{0}{1}$. Ans.

3. ·035 of £150·875 = £5·280625, which, divided by 880 = ·0060007+. Ans.

STANDARD VII.

1. 4 per cent. is $\frac{1}{25}$ for a year, hence $\frac{1}{2}$ of $\frac{1}{25} = \frac{1}{50}$ for half a year. Then, adding $\frac{1}{50}$ successively for each of the 5 half years, as below, we have—

	£		
$\frac{1}{50}$	1000		
	20	1st half-year's interest	
$\frac{1}{50}$	1020		
	20·4	2nd ,,	,,
$\frac{1}{50}$	1040·4		
	20·808	3rd ,,	,,
$\frac{1}{50}$	1061·208		
	21·22416	4th ,,	,,
$\frac{1}{50}$	1082·43216		
	21·6486432	5th ,,	,,
	1104·0808032 = £1104 1s. 7·392768d.	Amount. Ans.	

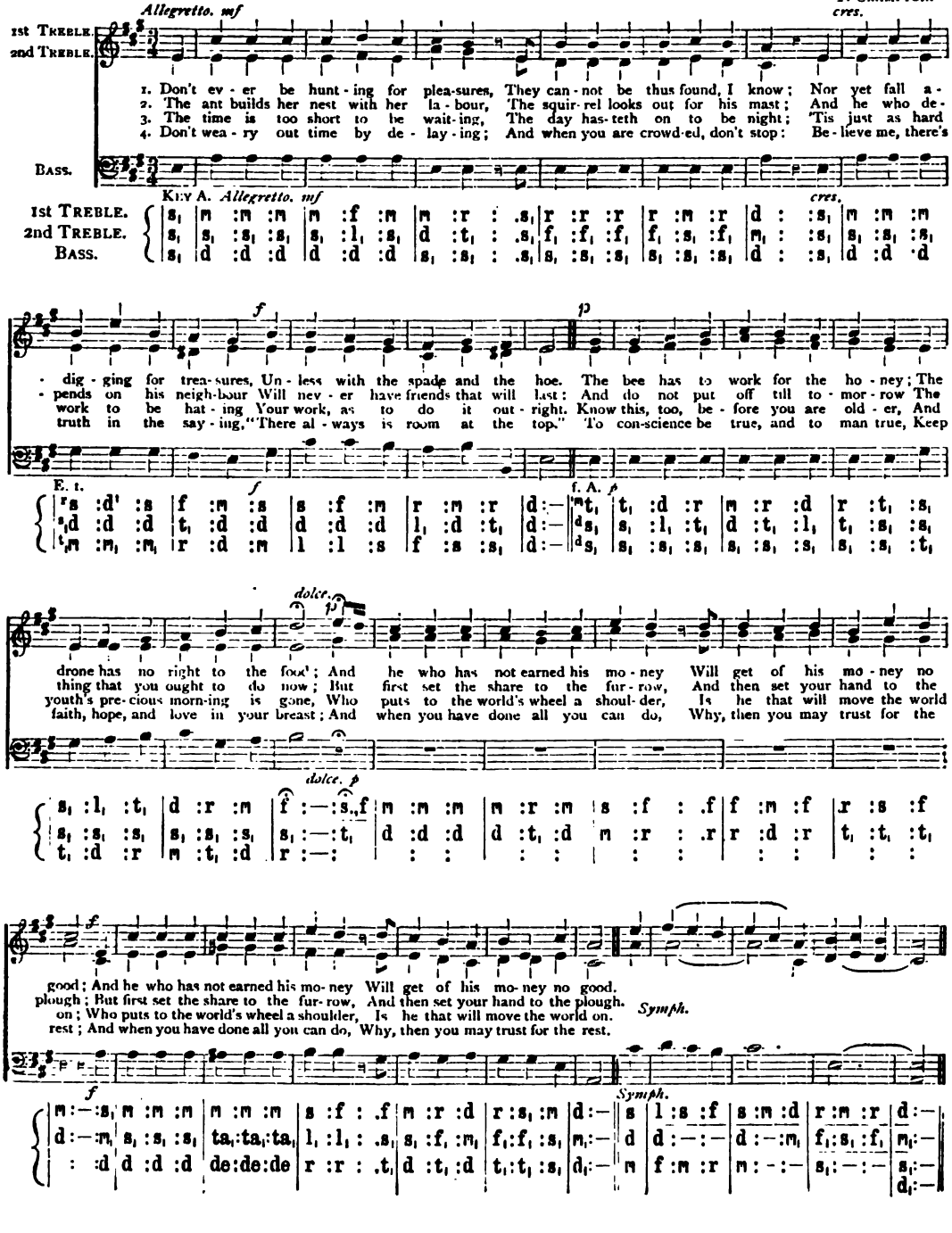
2. As 6d. in the £, *i.e.*, $\frac{1}{40}$ of the interest made, is paid as income tax, £5 must be $\frac{3}{40}$ of the gross interest; hence £5 × $\frac{40}{3}$ = £$5\frac{5}{3}$, gross interest on £100. As £100 makes £$5\frac{5}{3}$ interest, the principal that makes £4 gross interest must be $\frac{4}{5\frac{5}{3}}$ or $\frac{4}{1\frac{5}{3}}$ of £100 = £78. Ans.

Proof.—£78 makes £4 gross interest, from which (6d. × 4 =) 2s. must be deducted as income tax, leaving £3 18s., or 78, which is just 5 per cent. on £78.

3. At 2s. 8d. a lb., £100's worth of tea sells for £140, and in the latter case will sell for £125; hence $\frac{1}{1}\frac{4}{2}\frac{0}{5}$, or $\frac{8}{1}\frac{0}{5}$ of 2s. 8d. = 2s. 4$\frac{4}{5}$d., the selling price of a lb. to gain 25 per cent. Then (5s. ÷ 2s. 4$\frac{4}{5}$d.) = (60d. ÷ 28$\frac{4}{5}$d.) = (420 ÷ 200) = $2\frac{1}{10}$ lb. Ans.

RULES OF LIFE.

T. CRAMPTON.


Allegretto. mf
cres.
1st TREBLE.
2nd TREBLE.
BASS.
1. Don't ev - er be hunt - ing for plea-sures, They can - not be thus found, I know; Nor yet fall a -
2. The ant builds her nest with her la - bour, The squir - rel looks out for his mast; And he who de -
3. The time is too short to be wait - ing, The day has-teth on to be night; 'Tis just as hard
4. Don't wea - ry out time by de - lay - ing; And when you are crowd-ed, don't stop: Be - lieve me, there's
KEY A. Allegretto. mf
cres.
1st TREBLE.
2nd TREBLE.
BASS.
f
p
- dig - ging for trea-sures, Un - less with the spade and the hoe. The bee has to work for the ho - ney; The
- pends on his neigh-bour Will nev - er have friends that will last: And do not put off till to - mor - row The
work to be hat - ing Your work, as to do it out - right. Know this, too, be - fore you are old - er, And
truth in the say - ing, "There al - ways is room at the top." To con-science be true, and to man true, Keep
E. t.
f
f. A.
p
dolce.
p
drone has no right to the food; And he who has not earned his mo - ney Will get of his mo - ney no
thing that you ought to do now; But first set the share to the fur - row, And then set your hand to the
youth's pre-cious morn-ing is gone, Who puts to the world's wheel a shoul - der, Is he that will move the world
faith, hope, and love in your breast; And when you have done all you can do, Why, then you may trust for the
dolce. p
f
good; And he who has not earned his mo - ney Will get of his mo - ney no good.
plough; But first set the share to the fur - row, And then set your hand to the plough.
on; Who puts to the world's wheel a shoulder, Is he that will move the world on.
rest; And when you have done all you can do, Why, then you may trust for the rest.
Symph.
f
Symph.

The Practical Teacher.

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Scholarship Examination, 1882.

QUESTIONS WITH ANSWERS.

Arithmetic.

MALE CANDIDATES.

Three hours allowed for this Paper.

Candidates may answer all the questions.

The *solution* must be given at such length as to be intelligible to the examiner, otherwise the answer will be considered of no value.

1. Add together the products of each pair of the numbers 150, 225, 375, and find the difference between this sum and the product of all three numbers.

$150 \times 225 = 33{,}750$
$150 \times 375 = 56{,}250$
$225 \times 375 = 84{,}375$
$174{,}375$

$150 \times 225 \times 375 = 12{,}656{,}250$
Take away $174{,}375$
$12{,}481{,}875$. Ans.

2. Divide 16 acres 3 roods 2 poles among four brothers, giving the eldest brother half as much again as each of the others, and find the value of the eldest brother's share at a guinea for each pole.

Eldest brother's share 1½, each of the others 1, or 3, 2, 2, 2. Total, 9.
16 ac. 3 r. 2 pls. ÷ 9 = 1 ac. 3 r. 18 pls.

	a.	r.	p.		a.	r.	p.
Eldest brother's share =	1	3	18 × 3 =	5	2	14	
Each of the others =	1	3	18 × 2 =	3	2	36	

5 a. 2 r. 14 p. = 894 poles.
894 poles at £1 1s = £938 14s. Ans.

3. Find, by practice, the value of 17 lbs. 11 ozs. 16 dwts. 9 grs. of gold, at £3 12s. 8d. per oz.

17 lbs. 11 ozs. 16 dwts. 9 grs. = 215 oz. 16 dwts 9 grs.

	£	s.	d.		£	s.	d.
10 dwts. = ½ oz.	3	12	8				
	215						
	781	3	4	v. of 215 oz. at	3	12	8 p. oz.
5 dwts. = ½ of 10 dwts.	1	16	4	,, 10 dwts.	,,		,,
1 dwt. = ⅕ of 5 dwts.	0	18	2	,, 5 ,,	,,		,,
8 grs. = ⅓ dwt.	0	3	$7\frac{1}{5}$	,, 1 ,,	,,		,,
1 gr. = ⅛ of 8 grs.	0	1	$2\frac{3}{15}$	,, 8 grs.	,,		,,
	0	0	$1\frac{8}{15}$	,, 1 ,,	,,		,,
Ans.	£784	2	$9\frac{7}{15}$	,, 215 oz. 16 dwts. 9 grs. at £3 12s. 8d. per oz.			

4. Find the difference between $\frac{\frac{1}{2}-\frac{1}{3}}{\frac{1}{3}+\frac{1}{5}}$ of 19s. 10d., and $\frac{3\frac{1}{4}+2\frac{1}{8}}{3\frac{1}{4}-2\frac{1}{8}}$ of $1\frac{1}{8}$d., and reduce the difference to the fraction of 4s. $5\frac{1}{2}$d.

$$\frac{\frac{1}{2}-\frac{1}{3}}{\frac{1}{3}+\frac{1}{5}} \text{ of } 19\text{s. } 10\text{d.} - \frac{3\frac{1}{4}+2\frac{1}{8}}{3\frac{1}{4}-2\frac{1}{8}} \text{ of } 1\tfrac{1}{8}\text{d.}$$

$$= \frac{\frac{8-7}{56}}{\frac{9+8}{72}} \times \frac{238}{1} - \frac{5\frac{5+4}{20}}{1\frac{5-4}{20}} \times \frac{1}{4}$$

$$= \frac{1}{\cancel{56}} \times \frac{\overset{9}{\cancel{72}}}{\cancel{17}} \times \frac{\overset{2}{\cancel{238}}}{1} - \frac{109}{\cancel{20}} \times \frac{\cancel{21}}{\cancel{21}} \times \frac{1}{4}$$

$$= 18 - 9\tfrac{1}{2}$$

$= 8\frac{1}{2}\frac{1}{2}$d.

$8\frac{1}{2}\frac{1}{2}$d. to frac. of 4s. $5\frac{1}{2}$d.

$$= \frac{17}{12} \div \frac{187}{2} -$$

$$= \frac{\cancel{187}}{\cancel{12}} \times \frac{1}{\cancel{187}}$$

$$= \frac{1}{6}. \text{ Ans.}$$

5. Express as decimal of a pound $\frac{3}{5}$ of $5\frac{1}{4}$ of 3s. 9d., and find the value of that decimal of a yard.

$\frac{3}{5}$ of $5\frac{1}{4}$ of 3s. 9d. as dec. of a £

$= \frac{3}{5} \times \frac{21}{4} \times \frac{\overset{3}{\cancel{15}}}{4} \times \frac{1}{\cancel{20}}$
$\quad\quad 4$

$= \frac{189}{1\,2\,0\,0} = .360140625$. Ans.

.369140625 of a yard.
3
ft. 1·107421875
12

ft. 1, in. 1·289062500 Ans.

6. Write out clearly and concisely the rules for—

(*a*) Finding the G.C.M. of two numbers;
(*b*) Finding mentally the product of 1616 by 625;
(*c*) Subtraction of vulgar fractions.

(*a*) Divide the greater by the less; if there be a remainder, divide the first divisor by it; if there be still a remainder, the second divisor by it, and so on, always dividing the last preceding divisor by the last remainder till nothing remains. The last divisor is the G.C.M.

(*b*) 625 is $\frac{1}{8}$ of 5000.
∴ divide by 8 and multiply the quotient by 5000
1616 ÷ 8 = 202. 202 × 5000 = 1,010,000

(*c*) Reduce to a common denominator: subtract the lesser from the greater numerator, for a numerator to the common denominator.

7. If the larger wheel of a bicycle, whose circumference is 8 yds. 0 ft. $5\frac{1}{2}$ in., make 200 more revolutions than that of another bicycle in travelling 5 miles, find the circumference of the latter wheel.

No. of revolutions of 1st wheel = 5 miles ÷ 8 yds. 0 ft. $5\frac{1}{2}$ in.
= 950400 ÷ 880 = 1080.
No. of revolutions made by 2nd wheel = 1080 − 200 = 880.
Circumference of 2nd wheel = 5 miles ÷ 880.
= 8800 yds. ÷ 880 = 10 yards. Ans.

8. 320 men begin a piece of work; it is completed in 6 days of 10 hours each, but on each day only half of those employed on the previous day are at work; in what time would 105 men working 6 hours a day have completed it?

Average No. of men working = (320 + 160 + 80 + 40 + 20 + 10) ÷ 6 = 105.
105 men would do the work in 6 days of 10 hours
∴ 105 men would do the work in 10 days of 6 hours each. Ans.

9. Find the present value of £1363 due 5 years hence at $3\frac{1}{2}$ per cent. per annum simple interest.

£100 would produce £$3\frac{1}{2} \times 5$ = £$16\frac{1}{2}$
Present value of £$116\frac{1}{2}$ = 100.
∴ £$116\frac{1}{2}$: £100 :: £1363 : P.V.
= £1160. Ans.

10. A sum of £8505 invested in the Three per Cents. produces an income of £252; what is the price of the stock?

No. of cents. = 252 ÷ 3 = 84.
For £8400 stock, £8505 was paid
∴ Price of stock = $\frac{8505}{8400}$ = £$101\frac{1}{4}$. Ans.

11. Extract the square root of ·892143 of $12\frac{1}{2}$ square feet.

·892143
$12\frac{1}{2}$
11·102224 (3·332 ft. Ans.
9
63)210
189
663) 2122
1989
6662) 13324
13324

12. 800 yards of cloth are bought at 10s. 6d. per yard; half is sold for 10s. per yard, a fifth for 11s.; at what price must the remainder be sold to obtain a gain of $5\frac{1}{2}$ per cent. on the whole?

	£	s.
Cost price = 800 at 10s. 6d. =	420	0
$5\frac{1}{2}$ per cent. on £420 =	23	2
Total selling price =	443	2

£
$\frac{1}{2}$ of 800, *i.e.*, 400 at 10s. = 200
$\frac{1}{5}$ of 800, *i.e.*, 160 at 11s. = 88
288 0

Selling price of remainder (800 − 560) 240 = £155 2
Price per yard = £155 2s. ÷ 240 = 12s. $11\frac{1}{5}$d. Ans.

Euclid, Algebra, and Mensuration.

Three hours allowed for this Paper.

Candidates who attempt either of the questions in Mensuration must omit questions 11 and 12.

(Marks are given for portions of questions.)

Euclid.

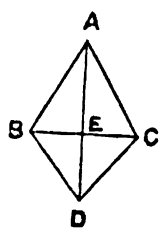
In the Euclid questions all generally understood abbreviations for *words* may be used, but no symbols of *operations* (such as −, +, ×) are admissible.

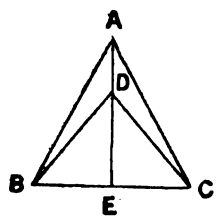
N.B.—Capital letters, not numbers, must be used in the diagrams.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, and have likewise their bases equal, the angle which is contained by the two sides of the one shall be equal to the angle contained by the two sides equal to them of the other.

On the base of an isosceles triangle, an equilateral triangle is described: show that the line joining the vertices of the two triangles bisects their common base at right angles.

Euclid I. 8.





[Two answers.

On the base BC of the isosceles triangle ABC, describe the equilateral triangle BDC. Join AD. AD or AD produced shall bisect the base BC in E.

AB = AC; and AD is common to the two triangles BAD and CAD.

∴ BA, AD = CA, AD, each to each, and base BD = base CD.

∴ angle BAD = angle CAD (Prop. 8.)

Again BA = AC, and AE is common to the two triangles BAE, CAE;

∴ BA, AE = CA, AE; and angle BAE = angle CAE.

∴ base BE = base EC, and angle AEB = angle AEC, and they are adjacent angles.

∴ each is a right angle (Def. 10.)

Wherefore AD or AD produced bisects BC at right angles.

2. What is the axiom on which Euclid bases his reasonings on parallel lines? Is Proposition 17 of the first book the converse of that axiom? If so, is there any objection to the axiom?

If a straight line fall on two parallel straight lines, it makes the alternate angles equal to one another, and the exterior angle equal to the interior and opposite angle on the same side; and also the two interior angles on the same side together equal to two right angles.

Axiom xii.

If a straight line meet two straight lines so as to make the two interior angles on the same side of it taken together less than two right angles, these straight lines being continually produced, shall at length meet on that side on which are the angles which are less than two right angles.

Yes.

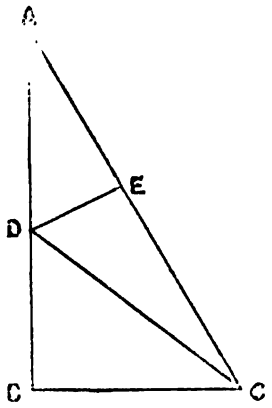
An axiom should be self-evident, and its converse the same. Were the twelfth axiom self-evident, then there would be no necessity for the proof of its converse in Prop. 17.

Prop. 29.

3. In any right-angled triangle, the square which is described on the side subtending the right angle is equal to the squares described on the sides which contain the right angle.

From the middle point of a side of a right-angled triangle, a perpendicular is drawn to the hypotenuse; show that the difference of the squares on the segments into which it is divided is equal to the square on the other side.

Euclid I. 47.



Sq. on DC = sqs. on DB, BC, (I. 47.)
and AD = DB, (Hyp.)
∴ sq. on DC = sqs. on AD, BC.
But sq. on AD = sqs. on AE ED (I. 47.)
and the sq. on DC = sqs. on DE, EC (I. 47.)
∴ sqs. on DE, EC = sqs. on DE, EA, and BC.
Take away the common sq. DE.
∴ sq. on EC = sqs. on EA and BC.
i.e. the sq. on EC is greater than the sq. on EA by the sq. on BC. Q. E. D.

4. By what proposition of the first book is it proved that the area of a triangle, whose altitude is (*a*) units long, and whose base is (*b*) units long, is $\frac{1}{2}ab$?

If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts, together with the square on the line between the points of section, is equal to the square on half the line.

Euclid I. 41.

Euclid II. 5.

5. Why cannot we satisfactorily demonstrate propositions of the second book by algebraical processes?

In every triangle the square on the side subtending an acute angle is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides, and the straight line intercepted between the perpendicular let fall on it from the opposite angle and the acute angle.

Because of the existence of *incommensurable* magnitudes. When the sides of rectangles can be expressed exactly in units of some measure of length, then the first 10 propositions of the second book can be expressed by algebraic symbols, but not otherwise.

Euclid II. 13.

Algebra.

6. Express algebraically: The fourth power of the sum of two numbers (*a* and *b*), together with twice the product of their squares, is equal to the sum of their fourth powers together with four times the product of their product and the square of their sum. Also verify it when $a=2$, $b=3$.

$$(a+b)^4+2a^2b^2=a^4+b^4+4ab(a+b)^2.$$
$$(a^2+2ab+b^2)^2+2a^2b^2=a^4+b^4+4ab(a^2+2ab+b^2).$$
$$a^4+4a^3b+8a^2b^2+4ab^3+b4=a^4+4a^3b+8a^2b^2+4ab^3+b^4.$$
$$(2+3)^4+2(2^2\times3^2)=2^4+3^4+4\times2\times3(2+3)^2.$$
$$625+72=15+81+600.$$
$$697=\underline{697}. \text{ Ans.}$$

7. Subtract:—$(x+y)(3a-2b)$ from $(x+y)(3a+2b)$; and divide $x^2+y^2+1-2y+2x-2xy$ by $x-y+1$.

$$(x+y)(3a+2b)=3ax+3ay+2bx+2by.$$
$$(x+y)(3a-2b)=\underline{3ax+3ay-2bx-2by.}$$
$$4bx+4by.$$
$$=\underline{4b(x+y)}. \text{ Ans.}$$

$$x-y+1)\ x^2+y^2+1-2y+2x-2xy\ (\underline{x-y+1}. \text{ Ans.}$$
$$\underline{x^2 \quad + x - xy}$$
$$-xy+y^2-2y+x.$$
$$\underline{-xy+y^2-y.}$$
$$x-y+1.$$
$$\underline{x-y+1.}$$

8. Prove the rule for dividing one algebraical fraction by another, the letters denoting any numbers.

Let $\frac{a}{b}$ be divided by $\frac{c}{d}$, the letters denoting any numbers, and let the quotients be expressed by x and y respectively.

then $a = bx$, and $c = dy$.
and $ad = bdx$, and $bc = bdy$.
$$\therefore \frac{ad}{bc}=\frac{bdx}{bdy}=\frac{x}{y}=x\div y.$$

Simplify—

$$\left(x+2+\frac{4}{x-2}\right)\div\left(\frac{x^3}{x^2-4}-x\right)$$
$$=\left(\frac{x^2-4+4}{x-2}\right)\div\left(\frac{x^3-x^3+4}{x^2-4}\right)$$
$$=\frac{x^2}{x-2}\div\frac{4}{x^2-4}$$
$$=\frac{x}{x-2}\times\frac{x^2-4}{4}$$
$$=\underline{\frac{x^2+2x}{4}} \text{ Ans.}$$

9. Solve the equations:—

(1) $$-17\left(x-\frac{4-x}{3}\right)=12\left(5x-\frac{7+3x}{8}\right)$$

(2) $$\begin{cases}32x+81y=45\\28x-39y=369.\end{cases}$$

(3) $$\frac{3x}{x+2}-\frac{x-1}{6}=x-9$$

(1) $$-17\left(x-\frac{4-x}{3}\right)=12\left(5x-\frac{7+3x}{8}\right)$$
$$-17\left(\frac{3x-4+x}{3}\right)=12\left(\frac{40x-7-3x}{8}\right)$$
$$-136(4x-4)=36(37x-7)$$
$$-544x+544=1332x-252$$
$$-544x-1332x=-252-544$$
$$1876x=796$$
$$x=\tfrac{796}{1876}=\underline{\tfrac{199}{469}}. \text{ Ans.}$$

(2)
$$a.\ \begin{cases}32x+81y=45\\28x-39y=369\end{cases}$$
$$b.$$

Multiply *a* by 7 and *b* by 8, and subtract.

$$224x+567y=\quad 315$$
$$\underline{224x-312y=2952}$$
$$879y=-2637$$
$$\underline{y=-3}$$

Substitute value of y in *a*

$$32x-243=45$$
$$32x=288$$
$$\underline{x=9}. \text{ Ans.}$$

(3)
$$\frac{3x}{x+2}-\frac{x-1}{6}=x-9$$
$$6(3x)-(x-1)(x+2)=6(x-9)(x+2)$$
$$18x-x^2-x+2=6x^2-42x-108$$
$$-7x^2+59x=-110$$
$$x^2-\tfrac{59}{7}x=15\tfrac{10}{7}$$
$$x^2-\tfrac{59}{7}x+(\tfrac{59}{14})^2=15\tfrac{10}{7}+(\tfrac{59}{14})^2 \text{ or } \tfrac{6561}{196}$$

Extract the square root.

$x - \frac{11}{14} = \pm\frac{11}{14}$

$x = \pm\frac{11}{14} + \frac{11}{14}$

$x = 10$ or $-1\frac{3}{7}$. Ans.

10. Prove that the difference between the cube of the sum of any two numbers and the sum of their cubes is divisible by three times their product.

Let a and b represent any two numbers.

Then $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

and $a^3 + b^3 = a^3 \qquad + b^3$

Their difference $= 3a^2b + 3ab^2$

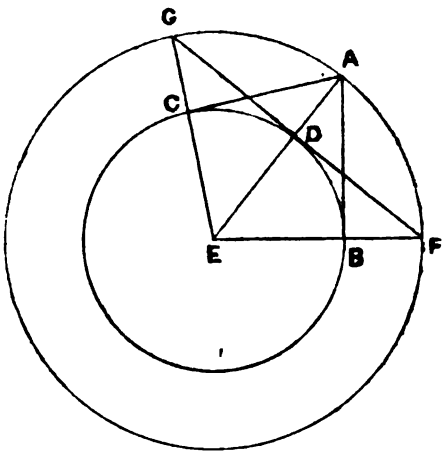
$3ab$ = three times the product of a and b

$3a^2b + 3ab^2 \div 3ab = a + b$. Ans.

11. To draw a straight line from a given point without the circumference, which shall touch a given circle.

Show that two such lines can be drawn, and that they are equally inclined to the line which joins the given point with the centre of the given circle.

Euclid III. 17.



In Euclid III., 17, DF is drawn at right angles to ED; produce it to G, ∴ DG is at right angles to ED,

Join EG, cutting the circle BDC in C.

Join AC ∴ AC touches the circle BDC (Prop. 17.)

And AB touches BDG ∴ two lines can be drawn from A to touch BDC.

Again: EF = EG (Def. 15); and ED is common,

∴ EF, ED = EG, ED, each to each; and the angle EDF = the angle EDG, ∴ (I. 26) the angle GEA = the angle FEA.

And CE, EA = BE, EA

∴ CAE = BAE (I. 4). Q. E. D.

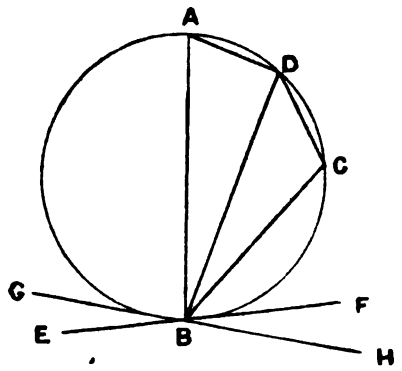
12. If a straight line touch a circle and from the point of contact a straight line be drawn cutting the circle, the angles which the line makes with the line touching the circle shall be equal to the angles which are in the alternate segments of the circle.

Write out the converse of this proposition.

Euclid III. 32.

If a straight line meet a circle and from the point of meeting a straight line be drawn cutting the circle, and the angle between the two straight lines be equal to the angle in the alternate segment of the circle, the straight line which meets the circle shall touch the circle.

Let the straight line EF meet the circle ABC, and from B, the point of meeting, let the straight line BD be drawn cutting the circle so as to make angle DBF equal to the angle BAD: the line EF touches the circle.



For if not, draw the line GH to touch the circle.

Then, because GH touches the circle ABC in B, the angle DBH is equal to the angle BAD (III. 32).

But DBF = BAD (Hyp.).

∴ DBF = DBH, the less to the greater, which is impossible

Wherefore GH does not touch the circle.

In like manner it may be shown that no other straight line but EF touches the circle.

∴ EF touches the circle. Q. E. D.

Mensuration.

13. The area of a chess-board which contains 64 equal squares, and an outer rim an inch wide, is 134·56 square inches; find the side of each square. Find also the width of the outer rim of another board of the same size in which the area of each square is 1·361 square inches.

$\sqrt{134{\cdot}56} = 11{\cdot}6$ inches, the side of the board.

Side of inner square $= 11{\cdot}6 - 2 = 9{\cdot}6$ inches.

As there are eight squares on each side,

$9{\cdot}6 \div 8 = 1{\cdot}2$ in. the side of each small square. Ans.

$\sqrt{1{\cdot}361} \times 8 = \sqrt{\frac{1361}{1000}} \times 8 = \frac{37}{10} \times 8 = \frac{148}{5} = 9\frac{3}{5}$ in. the side of the inner square.

$11{\cdot}6 - 9\frac{3}{5} = 11\frac{3}{5} - 9\frac{3}{5} = 2\frac{1}{5}$ in. double the border;

$2\frac{1}{5} \div 2 = 1\frac{1}{10}$ in. the width of the border. Ans.

14. The three sides of a triangle are in the ratio of 4:5:7, and their sum equals 32 yards; find the area of the triangle in yards to two places of decimals.

The sides of the triangles are $\frac{4}{16}$, $\frac{5}{16}$, and $\frac{7}{16}$ of 32 respectively; *i.e.* 8, 10, 14 yards.

$\frac{1}{2}(8+10+14) = 16$.

$16-8=8 : 16-10=6 : 16-14=2$.

Then $16 \times 8 \times 6 \times 2 = 1536$.

$\sqrt{1536} = 39{\cdot}19$ yards. Ans.

Arithmetic.

Three hours allowed for this Paper.

FEMALE CANDIDATES.

Candidates are not permitted to answer more than one question in each section.

The *solution* must in every instance be given at such length as to be intelligible to the examiner, otherwise the answer will be considered of no value.

SECTION I.

1. The first of 4 parcels of money contained two hundred and six pounds and twopence; the second, fifty sovereigns, seventeen half-sovereigns, and nine half-pence; the third, twenty-seven half-guineas and eightpence; the fourth, nineteen half-sovereigns and three half-crowns. Distribute the amount equally among 29 societies.

	£	s.	d.
(1) £206 os. 2d.	=206	0	2
(2) 50 sovs. + 17 half-sovs. + 9h-pence	= 58	10	4½
(3) 27 half-gui. + 8 pence	= 14	14	2
(4) 19 half-sovs. + 3 half-crowns	= 9	17	6
29)	288	12	2½
	£9	19s.	0½d. Ans.

2. One room contains 18 sq. yds. 3 sq. ft. 19 in.; a second 42 sq. yds. 8 ft. 11 in.; a third 29 sq. yds. 5 ft. 100 in. What must be added or subtracted in each case to make the rooms of average size?

	sq. yds.	sq. ft.	sq. in.	
(1)	18	3	19	
(2)	42	8	11	
(3)	29	5	100	
	3)90	7	130	Total area.
	30	2	91⅓	Average area.

30 sq. yds. 2 ft. 91⅓ in. − 18 sq. yds. 3 ft. 19 in.
= 11 sq. yds. 8 ft. 72⅓ in. added to the first.

42 sq. yds. 8 ft. 11 in. − 30 sq. yds. 2 ft. 91⅓ in.
= 12 sq. yds. 5 ft. 63⅔ in. taken from second.

30 sq. yds. 2 ft. 91⅓ in. − 29 sq. yds. 5 ft. 100 in.
= 5 ft. 135⅓ in. added to the third.

SECTION II.

1. A silversmith made a certain number of teaspoons weighing 26 lbs. 10 oz. 13 dwts., and a certain number of tablespoons weighing 38 lbs. 10 oz. 11 dwts. 18 grs. Find the cost of all the spoons at £3 17s. 11d. per oz.

	lbs.	oz.	dwts.	grs.
Teaspoons	26	10	13	0
Tablespoons	38	10	11	18
Total weight ...	65	9	4	18
	12			
	789 oz.			

	£	s.	d.	
	3	17	11	
	789			
	3073	16	3	value of 789 oz.
4 dwts. = ⅕ oz. =		15	7	,, 4 dwts.
12 grs. = ⅓ of 4 dwts. =		1	11⅗	,, 12 grs.
6 ,, = ½ of 12 grs. =			11⅘	,, 6 ,,
	£3074	14	9⅘	,, 789 oz. 4dwt. 18grs.

2. A farmer rents a farm of 400 acres on the following terms:—He pays as rent 100 qrs. of wheat, 75 qrs. of barley, and 60 qrs. of oats, the price of wheat, barley, and oats being respectively 49s. 6d., 30s. 8d., and 19s. 2d. per quarter. Give his average rent per acre in £ s. d.

	£	s.	d.
100 at 49s. 6d. =	247	10	0
75 at 30s. 8d. =	115	0	0
60 at 19s. 2d. =	57	10	0
Rent of 400 acres =	420	0	0
Rent of 1 acre = £420 ÷ 400 =	£1	1	0. Ans.

SECTION III.

1. Make out the following bill:—5 tons of coals at 15s. 6d. per ton, carriage of the same at 2s. 6d. per ton; 2 trucks of gravel (*i.e.*, 11¼ tons) at 5s. per ton, carriage of the same at 2s. 6d.

What are the two different kinds of practice called? Which kind is mostly used in bills of parcels? Give reasons for your answer.

Pimlico Wharf,
London, July 12th, 1882.

Mr. Burnett.

Bought of JAMES WHITE, *Coal-dealer*.

	£	s.	d.
5 tons of coals ... ... at 15s. 6d. per ton...	3	17	6
Carriage of same ... ,, 2s. 6d. ,, ...	0	12	6
2 trucks of gravel (11¼ tons) ,, 5s. 0d. ,, ...	2	17	6
Carriage of same ... ,, 2s. 6d. ,, ...	1	8	9
	£8	16	3 Ans.

Simple and *Compound*. *Simple*.

Because it is usual for sellers to give the price of simple quantities, and because persons are in the habit of buying even quantities, and not fractional parts of quantities.

2. Find the change out of a £10 note after paying the following bill:—12½ yards of flannel at 1s. 6d. per yard, 37 yards of calico at 1s. 0½d. per yard, 21 yards of muslin at 2s. 4½d. per yard, 18 yards of linen at 2s. 6d. per yard.

What is a Bill of Parcels? What else is it sometimes called? What rules of mental arithmetic can be applied in finding the amounts of the items?

	£	s.	d.
12½ yards at 1s. 6d. per yard =	0	18	9
37 ,, 1s. 0½d. ,, =	1	18	6½
21 ,, 2s. 4½d. ,, =	2	10	3½
18 ,, 2s. 6d. ,, =	2	5	0
	£7	12	7½

£10 − £7 12s. 7½d. = £2 7s. 4½d. change. Ans.

A detailed statement of goods bought, with the prices and quantities, together with the total values of the goods bought.

An Invoice.

Prices of dozens, scores, short methods of multiplication, and division.

SECTION IV.

1. Find by practice the rent of 311 acres 2 roods 26 perches at 5s. 8½d. per rood.

What rule does practice depend upon? And how is that rule simplified by it?

311 acres 2 roods 26 per.
1246 roods 26 per. at 5s. 8½d. per rood.

	£	s.	d.	
5s. = ¼ of £1	1246½			at 5s. 8½d.
	311	10	0	value of 1246 at 5s.
6d. = 1/10 of 5s.	31	3	0	,, ,, ,, 6d.
2d. = ⅓ of 6d.	10	7	8	,, ,, ,, 2d.
½d. = ⅛ of 2d.	1	5	11½	,, ,, ,, ½d.
1/20 of 5s. 8½d. =		3	8⅝	,, ½ at 5s. 8½d.
	£354	10	3⅝	,, 1246½ at 5s. 8½d.

Compound Multiplication.

The method of taking aliquot parts is shorter than that of multiplying by large numbers and fractions.

2. A bankrupt can only pay 12s. 6d. in the pound, and his debts amount to £1537 3s. 4d.; what is his estate worth? How much will be paid on a debt of £276 11s. 6d.?

What is meant by an 'aliquot' part?

12s. 6d. = ⅝ of a pound.

	£	s.	d.	
The estate = ⅝ of	1537	3	4	
	5			
8)	7085	16	8	
	£960	14	7	value of estate.
⅝ of £276 11 6				
	5			
8)	1382	17	6	
	£172	17	2½	paid on £276 11s. 6d.

Aliquot part: a part of a number which is contained in that number an exact of number times.

SECTION V.

1. The planting of a rood of ground cost £28 8s. 4d.; what was paid for planting 23 acres 3 roods 24 perches 11 sq. yds.?

Explain and define *measure, factor, multiple, sub-multiple.*

23 ac. 3 rd. 24 per. 11 yds. = 95 rd. 24 per. 11 yds.

	£	s.	d.	
20 per. = ½ of 1 rd.	28	8	4	cost of 1 rood.
			95	
	2693	11	8	,, 95 roods.
4 per. = ⅕ of 20 per.	14	4	2	,, 20 per.
11 yds. = 1/11 of 4 per.	2	16	10	,, 4 per.
	5	2		,, 11 yds. [yds.
	£2716	17	10	,, 95 rd. 24 per. 11 sq.

Measure: a number which will divide another without any remainder.

Factor: One of two or more numbers which multiplied together make another number.

Multiple: a number which contains another an exact number of times.

Sub-multiple: a multiple of any numbers which is contained in another multiple is called a sub-multiple.

2. Bought 176 yds. 2 qrs. 2 nls. 1½ in. at 18s. 9d. per English ell (=5 quarters), what is the gain or loss in selling at 6d. per inch?

Explain the terms *profit and loss, profit and loss per cent.*

176 yds. 2 qrs. 2 nls. 1½ in.
4

706 qrs. = 141 E. ells 1 qr.
4

2826 nls.
2½

5653½
7065/2

6360 in. 6d. = ½ of 1s. | 6360 at 6d.
20 | 3180

1 qr. = ¼ E. ell.

	£	s.	d.	
		18	9	cost per E. ell.
		141		
	132	3	9	,, of 141 E. ells.
2 nls. = ½ qr.		3	9	,, 1 qr.
1½ in. = ⅓ of 2 nls.		1	10½	,, 2 nls.
			7½	,, 1½ in.
	£132	10	0	cost price.

£3180 selling price.

Difference: gain = £26 10 0

Profit and loss are terms used to denote the gain or loss in mercantile transactions. If the selling price is greater than the cost price, the difference is *profit;* if less, the difference is *loss.*

Profit and loss per cent. means the gain or loss on every £100 expended.

SECTION VI.

1. If the road in front of a row of houses, three-quarters of a mile long, be repaired at a cost of £7 9s. 6d., what portion of the expense should be paid by an inhabitant whose premises have a frontage of 18 yards 2 feet?

Explain the difference between '*ratio*' and '*proportion.*'

How many kinds of proportion are there? State and explain the names given to the several parts in a proportion sum.

ml. yds. ft.
¾ : 18 2 :: £7 9s. 6d. : x
ft. ft.
= 3960 : 56
= £7 9s. 6d. × 56 ÷ 3960
= 2s. 1 1/11 d. Ans.

Ratio is the relative value of one number to another, and exists between two numbers; while

Proportion is made up of two ratios and requires four numbers, the first of which has the same relative value to the second that the third has to the fourth.

Two—*Simple* and *Compound.*

The first and fourth terms are called the *extremes;* the second and third the *means,* and are such that the product of the extremes is equal to the product of the means.

2. An engine of 16 horse-power can pump out ⅔ths of the water in a reservoir in 3 days, working 7 hours a day; in how many days will an engine of 15 horse-power, working 8 hours a day, empty the reservoir?

By what methods can the work be shortened in a proportion sum? Explain why these methods are correct.

H.P. 15 : 16 :: 3 days : x
Work 2 : 5
Hours 8 : 7

$$\frac{\cancel{3}\times\cancel{16}\times\cancel{5}\times 7}{\cancel{15}\times\cancel{2}\times\cancel{8}} = 7 \text{ days. Ans.}$$

By *cancelling, i.e.,* by taking out common factors from the first and the second or third terms.

Because multiplying and dividing a number by the same figure does not affect its value.

In the above example the factors common to the first, and the second and third terms are 3, 5, 8, and 2. 7, multiplied by 3, 5, 2, and 8, and divided by the same, would not be altered in value.

SECTION VII.

1. Two-sevenths of a farm is sown with wheat, four-ninths of it is pasture, and the remainder, woodland, contains 24 acres 2 roods 7 perches. Find the size of the farm.

What is a fraction? Name the different kinds of vulgar fractions, and distinguish between them.

$$1-(\tfrac{2}{7}+\tfrac{4}{9}) = \frac{63-(18+28)}{63} = \tfrac{17}{63}$$

17/63 = 24 a. 2 r. 7 per.
1/63 = 1 a. 1 r. 31 per.
63/63 = 90 a. 3 r. 33 per. Ans.

A *fraction* is a part or parts of a unit.

Kinds:—

Proper—having its numerator less than the denominator.
Improper—having a greater numerator than denominator.
Simple—having integral numbers only for numerator and denominator.
Compound—a fraction of a fraction.
Complex—a fraction with a fraction or mixed number in either or both numerator and denominator.
Mixed number—a whole number and a fraction.

2. If the owner of 4/17ths of a ship sold (5/17 of 3/5)ths of his share for £4992, what was the value of $\left(\frac{1\frac{1}{2}}{4\frac{1}{2}} \text{ of } \frac{2}{3}\right)$ths of the whole ship at the same rate?

Give and explain the names of the different parts of a vulgar fraction, and show their relation to each other and to the integer.

4/17 of 3/17 : 1½/4½ of ⅔ :: 4992

$$= \frac{1000}{\cancel{4992}_{13}} \times \frac{\cancel{4}}{\cancel{17}} \times \frac{\cancel{3}}{\cancel{8}} \times \frac{\cancel{17}}{\cancel{4}} \times \frac{\cancel{11}}{\cancel{3}} \times \frac{\cancel{3}}{\cancel{11}}$$

= £1000. Ans.

A *vulgar fraction* consists of two numbers divided by a line, the upper number being called the numerator, and the lower the denominator. The lower number shows the number of parts into which the integer is divided, and the upper number how many of those parts are taken.

If the upper number be considered as an integer, then the denominator shows into how many parts the numerator is divided.

SECTION VIII.

1. How much will remain of $\frac{1}{8}$ of £25·2 after the following articles have been paid for, namely:—1¼ yds. of cloth at £0·8 per yard, and 12·2 yds. of linen at £0·125 per yard? Give the answer in decimal form.

Name the different kinds of decimals, and distinguish between them.

$$\frac{1}{8} \text{ of } £25{\cdot}2 = \frac{176{\cdot}4}{9} = \underline{£19{\cdot}6}.$$

$$1\tfrac{1}{4} \text{ at } £0{\cdot}8 = \frac{7{\cdot}2}{5} = £1{\cdot}44.$$

$$12{\cdot}2 \text{ at } £{\cdot}125 = £1{\cdot}525.$$

$$£19{\cdot}6 - (1{\cdot}44 + 1{\cdot}525)$$
$$= 19{\cdot}6 - 2{\cdot}965$$
$$= £16{\cdot}635$$
$$= \underline{£16\ 12s.\ 8{\cdot}4d.} \quad \text{Ans.}$$

Terminating and *indeterminate* decimals; the latter are also called *repeating*, *recurring*, and *circulating* decimals.

Circulating decimals are of two kinds, pure and mixed. Pure circulating decimals are such as repeat the same figures from the beginning. Mixed circulating decimals are such as begin to repeat after one or more figures.

2. Find the value of $\frac{2}{3}$ of $\frac{1}{9\frac{1}{2}}$ of £1·18 + $\frac{3}{4}$ of 0·0375 of 15s. + $\frac{1}{2}$ of 0·429 of 8s. 3d., and express the result as the decimal of £5.

How may a vulgar fraction be converted into a decimal? What kind of vulgar fraction can produce no finite decimal? Explain why.

$$\frac{1}{9\frac{1}{2}} \text{ of } £1{\cdot}18 = \frac{3}{4} \times \frac{2}{19} \times \frac{236}{1} = £3 \quad 0 \text{ s. } 0 \text{ d.}$$

$$\frac{3}{4} \text{ of } {\cdot}0375 \text{ of } 15s. = \frac{2}{3} \times \frac{375}{1000} \times \frac{15}{1} = \tfrac{1}{2}s. = 0 \quad 4\tfrac{1}{2}$$

$$\frac{1}{2} \text{ of } {\cdot}429 \text{ of } 8s\ 3d. = \frac{2}{5} \times \frac{429}{1000} \times \frac{99}{1} = 1 \quad 5$$

$$4 \quad 9\tfrac{1}{2}$$

$$\frac{4s.\ 9\frac{1}{2}d.}{£5} = \frac{115}{2400} = \frac{23}{480} = \underline{{\cdot}047916}. \quad \text{Ans.}$$

By dividing the numerator by the denominator, after affixing cyphers to the numerator.

A vulgar fraction, which in its lowest terms has not 10 or 2 or 5, or some power of one or both these numbers, cannot produce a finite decimal fraction.

In order to turn a decimal fraction into a vulgar fraction, we have to divide the numerator by 10 or some power of 10. The only factors of 10 are 2 and 5, and, therefore, division by any other numbers will not terminate.

SECTION IX.

1. In what time will £436 10s. amount to £568 18·1s. at 7 per cent. per annum, simple interest.

Define *principal*, *amount*, *interest* (simple and compound), *discount*, *stocks*, *annuities*.

Total interest = £568 18·1s. − £436 10s. = £132 8·1s.
Interest of £436 10s. for a year at 7 per cent. = $\frac{7}{100}$ of

£436 10s. = £30 11·1s.

£30 11·1s.) £132 8·1s. (4·3 yrs.

20 / 611·1) 2648·10 (4·3 yrs.
20
24444
20370
18333
2037

4½ yrs. Ans.

Principal—money lent at interest.
Amount—principal + interest.
Interest—the money paid for the loan of money. When the interest is reckoned on the principal only it is called *Simple Interest*.

When at the end of the first period the interest is added to the principal, and for the next period interest is calculated on this new principal, and so on at the end of each period, the interest is called *Compound*.

Discount—abatement made for the payment of money before it is due.

It is the interest on the present worth of a debt from the present time to the time when the debt is due.

Stocks—the capital of trading companies, or the money borrowed by a government at so much per cent.

Annuities—yearly sums of money paid for the investment of a capital sum, or in return for payments made at intervals during a series of years.

2. A farmer mixes wheat: 9¾ qrs. at 38/6, the same quantity at 40/6 and at 42/9 per qr., and 24¾ qrs. at 45/-, and the same quantity at 47/- per qr. What is the average price of the mixture?

What is a *per-centage*, an *average*?

The average price of three lots = ⅓ (38/6 + 40/6 + 42/9)
= ⅓ of 121/9 = 40/7.
Do. of two lots = ½ of (45/- + 47/-) = 46/-.

	s.	d.
(9¾ × 3) at 40/7 =	28¼ at 40/7	= 1168 9¾.
(24¾ × 2) at 46/- =	49½ at 46/-	= 2263 2½.
Price of 78 qrs.		= 3432 0
,, 1 ,,		= 44/-. Ans.

A *per-centage* is a rate or proportion in every 100.
An *average* is a mean proportion; such a number as when distributed equally would produce the same amount as the total of the several parts.

Latin.

1. Translate into English:—

(*a*) Cæsar, quod neque colloquium interposita causa tolli volebat, neque salutem suam Gallorum equitatui committere audebat, commodissimum esse statuit, omnibus equis Gallis equitibus detractis, eo legionarios milites legionis decimæ, cui quam, maxime confidebat, imponere, ut præsidium quam amicissimum, si quid opus facto esset, haberet. Quod quum fieret, non irridicule quidam ex militibus decimæ legionis dixit: 'plus, quam pollicitus esset, Cæsarem ei facere: pollicitum, se in cohortis prætoriæ loco decimam legionem habiturum, nunc ad equum rescribere.'

(*b*) Nemo ipsam voluptatem, quia voluptas sit, aspernatur, aut odit, aut fugit; sed quia consequuntur magni dolores eos qui ratione voluptatem sequi nesciunt.

(*a*) Cæsar, as he neither wished the Conference to be set aside by the pretext that had been alleged, nor dared to trust his personal safety to the cavalry of the Gauls, deemed it most expedient, after taking away all their horses from the Gallic cavalry, to mount on them the legionary soldiers of the Tenth Legion, in which he had the most entire confidence, in order that he might have a guard as friendly to him as possible, if there should be any need for action. When this was done one of the soldiers of the Tenth Legion wittily observed, that Cæsar was doing more for it than he had promised: he had promised to have the Tenth Legion in place of a prætorian body-guard, but (now) he was transferring it to cavalry.

(*b*) No one despises or hates or shuns pleasure itself because (as he reflects) it is pleasure, but because great pains overtake those who do not know how to pursue pleasure judiciously.

2. Conjugate the verbs tolli, audebat, detractis, fieret, pollicitus esset, odit, consequuntur, nesciunt.

Tollo, tollĕre, sustuli, sublatum.
Audeo, audēre, ausus sum.
Detraho, detrahĕre, detraxi, detractum.
Fio, fieri, factus sum.
Polliceor, pollicēri, pollicitus sum.
No present, odisse, odi.
Consequor, consequi, consecutus sum.
Nescio, nescire, nescivi or nescii, nescitum.

Give the rules for the government of equitatui, equis, equitibus, facto, ratione.

Equitatui, dative of the remoter object governed by committere (Latin Primer, § 106, 3).

Equis, with detractis, forms an ablative absolute (Latin Primer, § 125).

Equitibus, dative of the remoter object governed by detractis (Latin Primer, § 106, 3).

Facto, ablative case of the passive participle factus, governed by opus (Latin Primer, § 119A).

Ratione, ablative of manner, used without preposition *cum*, like certain other words, jure, dolo, fraude, etc. (Latin Primer, p. 136 V.B).

Decline both in singular and plural.

	Dux, ille magnus.	*Haec dies serena.*
N.	Dux ille magnus.	Duces illi magni.
V.	Dux magne.	Duces magni.
A.	Ducem illum magnum.	Duces illos magnos.
G.	Ducis illius magni.	Ducum illorum magnorum.
D.	Duci illi magno.	Ducibus illis magnis.
A.	Duce illo magno.	Ducibus illis magnis.

N.	Haec dies serena.	*Hi dies sereni.
V.	dies serena.	dies sereni.
A.	Hanc diem serenam.	Hos dies serenos.
G.	Hujus diei serenæ.	Horum dierum serenorum.
D.	Huic diei serenæ.	His diebus serenis.
A.	Hac die serena.	His diebus serenis.

* Dies is always masculine in plural.

Give the genitive plural of pons, sedile, hostis, serpens, canis, and juvenis, and state the general rules for the formation.

Pontium, sedilium, hostium, serpentium and serpentum, canum, and juvenum.

Imparisyllabic nouns *generally* have gen. plur. in um.
Parisyllabic ,, ,, ,, ,, ium.

3. Translate into Latin:—

(*a*) Having left his army, he fled.
(*b*) I have received the letters which you sent me.
(*c*) The General sent soldiers to take the city.
(*d*) Having completely routed the enemy, he returned to the city with the spoils.
(*e*) Cæsar said that he would severely punish those Gauls who had so often rebelled against the Republic, and devastated the lands of the Allies.
(*f*) Scipio, when the Carthaginian ambassadors arrived to sue for peace, was only twelve miles distant from the city, which he had resolved to enter on the following day.

(*a*) Exercitu relicto, fugit.
(*b*) Quas epistolas ad me misisti, accepi.
(*c*) Imperator milites, qui urbeun caperent, misit.
(*d*) Hostibus penitus fugatis, cum praeda ad urbem rediit.
(*e*) Cæsar discit se graviter animadversurum esse in eos Gallos, qui a republica defecissent agrosque sociorum vastassent.
(*f*) Scipio, cum legati Carthaginienses pacem petitum venissent, ab urbe tantum duodecim millia passuum aberat, quam postero die intrare decreverat.

Greek.

1. Translate into English:—

(*a*) "Ἄνδρες στρατιῶται, μὴ θαυμάζετε, ὅτι χαλεπῶς φέρω τοῖς παροῦσι πράγμασιν. Ἐμοὶ γὰρ Κῦρος ξένος ἐγένετο, καί με, φεύγοντα ἐκ τῆς πατρίδος, τά τε ἄλλα ἐτίμησε, καὶ μυρίους ἔδωκε δαρεικούς· οὓς ἐγὼ λαβὼν, οὐκ εἰς τὸ ἴδιον κατέθεμην ἐμοί, ἀλλ' οὐδὲ καθηδυπάθησα, ἀλλ' εἰς ὑμᾶς ἐδαπάνων."

Soldiers! do not marvel that I am vexed at the present circumstances. For Cyrus was my friend, and honoured me when an exile from my country, both in other respects, and (in particular) he gave me ten thousa. d darics. After receiving these I did not lay them up for myself, for my own private purposes; nay, I did not even squander them in luxury, but I was in the habit of spending them on you.

(*b*) Κῦρος μὲν οὖν οὕτως ἐτελευτησεν, ἀνὴρ ὢν Περσῶν τῶν μετὰ Κῦρον τὸν ἀρχαῖον γενομένων βασιλικώτατός τε καὶ ἄρχειν ἀξιώτατος, ὡς παρὰ πάντων ὁμολογεῖται τῶν Κύρου δοκούντων ἐν πείρᾳ γενέσθαι Πρῶτον μὲν γὰρ παῖς ἔτι ὤν, ὅτε ἐπαιδεύετο καὶ σὺν τῷ ἀδελφῷ καὶ σὺν τοῖς ἄλλοις παῖσι, πάντων πάντα κράτιστος ἐνομίζετο. Πάντες γὰρ οἱ τῶν ἀρίστων Περσῶν παῖδες ἐπὶ ταῖς βασιλέως θύραις παιδεύονται· ἔνθα πολλὴν μὲν σωφροσύνην καταμάθοι ἄν τις, αἰσχρόν τε οὐδὲν οὔτ' ἀκοῦσαι, οὔτ' ἰδεῖν, ἔστι.

Thus then Cyrus died, being both the most kinglike man of (all) the Persians who have lived since Cyrus the Ancient; and the most worthy (of them) to command, as is acknowledged by all who appear to have been acquainted with Cyrus. For in the first place being yet a boy, when he was being educated with both his brother and the other boys, he was considered the best of all in everything. For all the sons of the noblest Persians are educated at the king's court; (and) there any one might learn much self-control, and it is not possible either to hear or to see anything disgraceful.

2. Parse fully *φέρω, φεύγοντα, κατεθέμην, γενομένων, κράτιστος, πολλὴν, καταμάθοι, οὐδὲν, ἰδεῖν.*

φέρω, Pres. Indic. Act. 1st Pers. Singular from *φέρω*, f. *οἴσω*, p. *ἐνήνοχα*, 1 A *ἤνεγκα*. Containing its subject 'I' in itself.

φεύγοντα, Pres. Part. Act. Accus. Sing. Masc. from *φεύγω*, f. *φεύξομαι*, p. *πέφευγα*, 2 A *ἔφυγον*. It agrees with *μέ*.

κατεθέμην, 2 Aor. Indic. Mid. 1st Pers. Sing. from *κατατίθημι*, f. *καταθήσω* (perf. *τέθεικα*), 2 A. M. *κατεθέμην*. It agrees with *ἐγώ*.

γενομένων, Gen. A. Part. Middle Pl. Mas. F., deponent verb *γίγνομαι*, f. *γενήσομαι*, perf. *γεγένημαι* and *γέγονα*, 2 A. *ἐγενόμην*. It agrees with *περσῶν*.

κράτιστος, Nom. Sing. Mas. joined by *ἐνομίζετο* to *κῦρος* understood. It is the superlative of *ἀγαθὸς*. Comp. *κρείσσων*, Sup. *κράτιστος*.

πολλὴν, Acc. Sing. Fem. (agreeing with *σωφροσύνην*), from *πολὺς, πολλή, πολύ*.

καταμάθοι, 2 Aor. Opt. Act. 3 Pers. Sing. from *καταμανθάνω*, f. *μαθήσομαι* (p. *μεμάθηκα*), 2 A. *κατέμαθον*.

οὐδὲν, Acc. Sing. Neut. from *οὐδείς, οὐδεμία, οὐδέν*, governed by *ἀκοῦσαι*.

ἰδεῖν, 2 Aor. Infin. Act. from *ὁράω*, f. *ὄψομαι*, p. *ἑώρακα*, 2 A. *εἶδον*. Subject of *ἐστί*.

3. Decline ὁ *μέγας Βασιλεύς* and *ὅς, ἥ, ὅ*.

N.	ὁ μέγας Βασιλευς.	οἱ μεγάλοι Βασιλέες —εῖς.
V.	μέγα βασιλεῦ.	μεγάλοι βασιλέες —εις.
A.	τὸν μέγαν βασιλέα.	τοὺς μεγάλους βασιλέας —εῖς.
G.	τοῦ μεγάλου βασιλέως.	των μεγάλων βασιλέων.
D.	τῷ μεγάλῳ βασιλέει —ῆι.	τοις μεγάλοις βασιλευσι.

N. V. A. τὼ μεγάλω βασιλέε.
G. D. τοῖν μεγάλοιν βασιλέοιν.

N.	ὅς, ἥ, ὅ.	οἵ, αἵ, ἅ.		
V.	*	*	N. V. A.	ὦ, ᾶ, ὦ.
A.	ὅν, ἥν, ὅ.	οὓς, ἅς, ᾶ.	G. D.	οἷν, ἅιν, ὅιν.
G.	οὗ, ἧς, οὗ.	ὧν, ὧν, ὧν.		
D.	ᾧ, ᾗ, ᾧ.	οἷς, αἷς, οἷς.		

Give Gen. Sing. and Dat. Plural of *ἀνήρ, πόλις, μητηρ*, and the Nom. and Gen. Dual of *ἐπιστολή, ἄνθρωπος* and *θυγατηρ*.

Gen. Singular.	Dat. Plural.
ἀνδρός.	ἀνδράσι.
πόλεως.	πόλεσι.
μητρός.	μητράσι.
Nom. Dual.	**Gen. Dual.**
ἐπιστολά.	ἐπιστολαῖν.
ἀνθρώπω.	ἀνθρώποιν.
θυγατερε.	θυγατέρον.

By what cases are *point of time, continuance of time*, and *the distance* of one place from another respectively expressed in Greek. Illustrate your answer by examples.

Point of time is expressed by the Dative, as

τῇ τρίτῃ ἡμέρᾳ ἀπῆλθε
On the third day he departed.

Continuance of time is expressed by the Accusative, as

τρεῖς ἡμέρας ἔμεινε
He remained (during) three days.

Distance of one place from another is expressed by the Accusative, as

ἀπέχει τρεῖς σταδίους
It is three stadia off.

Translate into Greek—

a. The good daughter loves her brother.

b. The bad boy struck the dog with a stone.

c. He gave me Xenophon's expedition of Cyrus.

d. There was a battle between the heavy-armed soldiers and the archers.

e. Having collected a large army and many ships, he laid siege to the city both by sea and by land.

a. ἡ ἀγαθὴ θυγατὴρ τὴν μητέρα φιλεῖ.

b. ὁ πονηρὸς παῖς τὸν κύνα ῥάβδῳ ἐπάταξεν.

c. ἔδωκέ μοι Ξενοφῶντος Κύρου ἀνάβασιν.

d. οἱ ὁπλῖται καὶ οἱ τόξοται μάχην ἀλλήλοις συνῆψαν.

e. συλλέξας μέγα στράτευμα καὶ πολλὰς ναῦς τὴν πόλιν ἐπολιόρκει καὶ κατὰ γῆν καὶ κατὰ θάλατταν.

French.

1. Translate into English:—

Le possesseur de tant d'îles et de continents n'avait pas un toit pour abriter sa tête. 'Si je veux manger ou dormir,' écrit-il de Séville à son fils, 'il faut que je frappe à la porte d'une hôtellerie, et souvent je n'ai pas de quoi y payer mon repas et ma nuit!' Ses malheurs et son indigence lui étaient moins intolérables que la misère de ses compagnons et de ses serviteurs, qu'il avait attachés par tant d'espérances à sa fortune, et qui lui reprochaient leur déception et leur misère. Il écrivit au roi et à la reine en leur faveur. Mais l'ingrat Porras, ce révolté vaincu, qui devait la vie à sa magnanimité, l'avait devancé, à la cour, et pervertissait contre son bienfaiteur l'esprit de Ferdinand. 'J'ai servi Vos Majestés,' écrivait Colomb au roi et à la reine, 'avec autant de zèle et de constance que j'aurais fait pour mériter le paradis, et, si j'ai failli en quelque chose, c'est parce que mon esprit ou mes forces n'allaient pas au delà!'

The possessor of so many islands and continents had not a roof to shelter his head. 'If I want to eat or to sleep,' he writes from Seville to his son, 'I have to knock at the door of an inn; and often I have not wherewith to pay for my meal and night's rest there!' His misfortunes and his poverty were less intolerable to him than the misery of his companions and his servants, whom he had attached to his fortunes by so many hopes, and who reproached him for their deception and their misery. He wrote to the king and the queen on their behalf. But the ungrateful Porras, that vanquished rebel, who owed his life to his magnanimity, had forestalled him at court, and was perverting Ferdinand's mind against his benefactor. 'I have served your majesties,' wrote Colombus to the king and the queen, 'with as much zeal and constancy as I should have done to merit Paradise, and if I have failed in anything, it is because my mind or my strength did not reach so far.'

2. Parse fully—tant, il faut, devait, attachés, vaincu, failli.

tant—adverb of quantity, and followed, consequently, by the preposition *de*. (This is a reproduction in French of the Latin idiom in which a neuter pronoun is followed by the genitive.)

il faut—verb, irregular, impersonal; 3rd conjugation; indicative mood, present tense, 3rd person singular; principal parts, falloir, —, fallu, il faut, il fallut; future, il faudra.

devait—verb, active, transitive; 3rd conjugation; indicative imperfect, 3rd singular, agreeing with 'qui;' principal parts, devoir, devant, dû, je dois, je dus; future, je devrai.

attachés—past participle passive of the regular verb 'attacher,' of the 1st conjugation, agreeing here in the plural masculine with 'que,' which precedes the auxiliary 'avait.'

vaincu—a participial adjective, agreeing in gender and number with 'révolté;' from the irregular verb vaincre, vainquant, vaincu, je vaincs, je vanquis; future, je vaincrai.

failli—past participle forming with 'j'ai' the preterite indefinite of faillir, a defective verb of the 2nd conjugation, used only in the infinitive present, in the participle past, and in the preterite definite, je faillis, and in the compound tenses.

3. Give the feminines of *mon, ingrat, leur, vaincu;* the preterites of *vouloir, payer, devoir, aller, avoir;* the plurals of *fils, roi, jeu, ciel.*

mon—fem. *ma*. *ingrat*—fem. *ingrate*. *leur*—fem. *leur*. *vaincu*—fem. *vaincue*.

je voulus, tu voulus, il voulut, nous voulûmes, vous voulûtes, ils voulurent.
je payai, tu payas, il paya, nous payâmes, vous payâtes, ils payèrent.
je dus, tu dus, il dut, nous dûmes, vous dûtes, ils durent.
j'allai, tu allas, il allat, nous allâmes, vous allâtes, ils allèrent.
j'eus, tu eus, il eut, nous eûmes, vous eûtes, ils eurent.
fils—plu. *fils*. *roi*—plu. *rois*. *jeu*—plu. *jeux*.

ciel—plu. { *cieux* = heavens. / *ciels* = bed-testers, skies in pictures.

4. Name some neuter verbs which employ être with the past participle, and point out the consequent difference as to the agreement of the past participle with the subject of the sentence.

aller	... to go.	naître	... to be born.
arriver	... to arrive.	partir	... to set out.
décider	... to die.	parvenir	... to attain.
déchoir	... to decay.	rester	... to stay, remain.
devenir	... to become.	revenir	... to come back.
éclore	... to blow, to be hatched.	survenir	... to happen.
entrer	... to come in.	tomber	... to fall.
mourir	... to die.	venir	... to come.

The past participle of these verbs will consequently agree in gender and number with the subject of the sentence. Thus:—

My sister died last year—ma sœur est *morte* l'année dernière.
I am glad they are come—je suis aise qu'ils soient *venus*.
We set out yesterday—nous sommes *partis* hier.
I am afraid the table has fallen—je crains que la table ne soit *tombée*.
She is the only person who has come to congratulate us—c'est la seule personne qui soit *venue* nous féliciter.
The roses are blown—les roses sont écloses.

5. Translate into French:—

He wrote to his wife: "My misfortunes are less intolerable than the misery of my children, and I will write to the king on their behalf.' He knew that he had served the king with the greatest zeal, and that if he had failed in anything it was only because his strength did not reach so far.

Il écrivit à sa femme: 'Mes malheurs sont moins intolérables que la misère de mes enfants, et je vais écrire (*or* j'écrirai) au roi en leur faveur.' Il savait qu'il avait servi le roi avec le plus grand zèle, et que s'il avait failli en quelque chose, ce n'était que parce que ses forces n'allaient pas au delà.

German.

(German words must be written in the English character.)

1. Translate into English:—

So waren die Meinungen der Grossen Getheilt. Die Wenigsten stimmten für den Krieg, die Meisten sür den Frieden oder für die Flucht. Ibrahim hörte Alles, was man ihm rieth, mit Ruhe an, dankte für die guten Gesinnungen, welche man für seine Person zeigte, und setzte endliche hinzu: 'Es ist wahr, Flucht würde meine Person am besten sichern, aber meine Unterthanen würden unstreitig am meisten leiden. Schrecklich würde die Rache des Eroberers mein armes Land treffen, wenn ich selbst es aller Mittel der Vertheidigung beraubte. Ich danke daher dem Himmel, dass mir noch ein besseres Mittel zu Gebote steht, Euch alle zu retten. Bald sollt Ihr mehr hören; bittet unterdessen den Himmel, dass er mein Vorhaben gelingen lassen wolle!'

Thus were the opinions of the nobles divided. The minority voted for war, the majority for peace or for flight. Ibrahim listened calmly to all the counsel that was given him, expressed his thanks for the kindly feelings that were manifested towards himself, and finally added: 'It is true, flight would best secure my safety, but my subjects would undoubtedly suffer most. Terribly would the vengeance of the conqueror afflict my poor country if I myself deprived it of all means of protection. I

thank Heaven, therefore, that a still better means is at my command, to save you all. Soon you shall hear more; meanwhile, pray Heaven that it will prosper my design!'

2. Parse fully Wenigsten, rieth, würde, sollt, gelingen, am meisten.

Wenigsten—adjective of quantity, used as a noun; nominative plural, superlative of Wenig; subject of 'stimmten.'
rieth—verb, irregular, transitive; conjugated rathen, rieth, gerathen; 3rd singular, indicative, imperfect past tense, agreeing with 'man.'
würde—auxiliary verb, 1st conditional tense, 3rd singular, agreeing with 'Flucht;' conjugated werden, ward or würde, geworden.
sollt—auxiliary verb of mood; present indicative, 2nd plural, agreeing with 'Ihr;' conjugated sollen, sollte, gesollt.
gelingen—verb, intransitive, irregular; infinitive mood, present tense, dependent upon 'lassen;' conjugated gelingen, gelang, gelungen.
am meisten—contraction for an dem meisten—an adverbial expression formed from 'meist.'

3. Give the plurals of Krieg, Person, Kind, Mittel; the comparatives of gut mächtig, and the numerals from five to fourteen.

Singular.	*Plural.*
Krieg	Kriege.
Person	Personen.
Kind	Kinder.
Mittel	Mittel.

Positive.	*Comparative.*
gut	besser.
mächtig	mächtiger.

five.....fünf.	nine .....neun.	thirteen ...dreizehn.
six .....sechs.	ten .....zehn.	fourteen...vierzehn.
seven ...sieben.	eleven ...elf.	
eight ...acht.	twelve .. zwölf.	

4. Give with examples some of the separable prefixes employed in the composition of German verbs.

Simple separable prefixes:—

ab: abreisen—to set out; Ich reise ab; abgereist.
an: ankommen—to arrive; Ich komme an; angekommen.
auf: aufstehen—to get up; Ich stehe auf; aufgestanden.
aus: ausgehen—to go out; Ich gehe aus; ausgegangen.
bei: beistehen—to assist; beitragen—to contribute.
dar: darstellen—to represent; darbringen—to offer.
ein: einführen—to introduce; einladen—to invite.
fort: fortfahren—to go on; fortbegleiten—to see off.
her: herbringen—to bring hither.
heim: heimkehren—to return home.

Compound separable prefixes:—

dahin: dahineilen—to hasten away.
darauf: daraufbestehen—to insist upon.
hervor: hervorbringen—to bring forth.
hinzu: hinzueilen—to hasten thither.
überein: übereinkommen—to agree.
zurück: zurückschicken—to send back.

5. Translate into German:—

How much must I pay?.....	Wie viel muss ich bezahlen?
You ought to have come two hours ago	Sie hätten zwei Stunden früher kommen sollen.
What kind of weather shall we have to-day?.....	Was für Wetter werden wir heute haben?
My hat is smaller than my father's	Mein Hut ist kleiner als *or* der derjenige Meiner Vaters.
Queen Victoria came to the throne in 1837	Königin Victoria bestieg den Thron in achtzehn hundert sieben und dreizig.
At what o'clock do you wish to start?	Um welche Uhr wollen Sie abfahren?
If you do not do it you will be blamed.....	Wenn Sie es nicht thun, werden Sie getadelt werden.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE LITTLE LEARNER,' FOR DECEMBER, 1882.

STANDARD I.

A. (1) 6
(2) 7
(3) 9
B. (1) 10
(2) 14
(3) 16
C. (1) 20
(2) 21
(3) 30
D. (1) 99
(2) 114
(3) 156
E. (1) 199
(2) 233
(3) 264
F. (1) 222
(2) 115
(3) 288
G. (1) 1,653
(2) 2,049
(3) 2,132
H. (1) 1,912
(2) 1,856
(3) 2,826
I. (1) 2
(2) 3
(3) 5
J. (1) 3
(2) 14
(3) 45
K. (1) 224
(2) 407
(3) 636
L. (1) 16
(2) 26
(3) 9
M. (1) 237
(2) 64
(3) 634
N. (1) 483
(2) 139
(3) 95
O. (1) 6,239
(2) 13,945
(3) 13,941
P. (1) 3,596
(2) 715
(3) 3,578

STANDARD II.

A. (1) 51,956
(2) 87,076
(3) 98,887
B. (1) 778
(2) 38,137
(3) 18,868
C. (1) 10,086
(2) 10,996
(3) 9,091
D. (1) 28,406
(2) 105,246
(3) 228,584
E. (1) 331,513
(2) 615,825
(3) 1,090,404
F. (1) 1,742,760
(2) 5,905,520
(3) 9,404,230
G. (1) 753,438
(2) 3,386,736
(3) 4,453,376
H. (1) 629,833
(2) 2,317,504
(3) 7,140,960
I. (1) 10,545,774
(2) 11,786,580
(3) 23,011,500
J. (1) 39,284,763
(2) 25,270,240
(3) 96,563,808
K. (1) 21,034
(2) 13,204
(3) 16,092
L. (1) 15,072
(2) 15,124
(3) 12,345
M. (1) 5,876+5
(2) 5,500+7
(3) 4,886+7
N. (1) 2,729,252,814
(2) 1,917,901,800
(3) 3,628,603,568
O. (1) 7,315+47
(2) 11,693+6
(3) 7,519+110

STANDARD III.

A. (1) 1,307
(2) 2,456
(3) 3,174
B. (1) 7,964+29
(2) 10,835+28
(3) 10,943+24
C. (1) 5,150+10
(2) 5,609
(3) 10,003
D. (1) 12,240+59
(2) 13,025+22
(3) 4,787+48
E. (1) 7,958+284
(2) 10,735+531
(3) 9,017+810
F. (1) 18s. 0½d.
(2) £3 5s. 3¾d.
(3) £4 1s. 1½d.
G. (1) £29 1s. 4½d.
(2) £37 15s. 6¾d.
(3) £25 15s. 2d.
H. (1) £275 0s. 0½d.
(2) £2,363 14s. 2½d.
(3) £18,810 5s. 4½d.
I. (1) 5½d.
(2) 8½d.
(3) 1¾d.
J. (1) 4s. 8½d.
(2) 5s. 3½d.
(3) 3s. 11¾d.
K. (1) £5 4s. 8¾d.
(2) £4 16s. 5¾d.
(3) £2 16s. 10½d.
L. (1) £8 5s. 10½d.
(2) £419 16s. 10½d.
(3) £366 17s. 7¾d.

ANSWERS TO
Pupil Teachers' Examination Papers.
OCTOBER 28TH, 1882.
CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Between 6.30 a.m. and 7.50 p.m. I found that my watch lost 1¾ minutes. How much does it lose in a day?

No. of hours from 6.30 a.m. till 7.50 p.m. = 13½.
13½ ho. : 24 ho. :: 1¾ min. : time lost in a day.
$\frac{7 \text{ min.} \times 72}{4 \times 40} = \frac{63}{16}$ min. = 3 min. 9 sec. Ans.

2. Find by practice the produce of 543 acres of wheat at 5 qrs. 3 bus. 1 pk. per acre.

		qrs.	bus.	pk.
Produce at 1 qr. per ac.	=	543	0	0
				5
,, 5 qrs. ,,	=	2715	0	0
,, 2 bu. ,,	= ½ at 1 qr. =	135	6	0
,, 1 ,, ,,	= ½ ,, 2 bu. =	67	7	0
,, 1 pk. ,,	= ¼ ,, 1 ,, =	16	7	3
		2934	4	3 Ans.

3. A nobleman possessing an annual rental of £4,562 10s. returned to his tenants 2s. 3d. in the £ on account of bad trade. What was the amount of his receipts?

		£	s.	d.
		4562	10	0
2s. in the £ = $\frac{1}{10}$ of the whole	=	456	5	0
3d. ,, = ¼ of that at 2s.		57	0	7½
deducting		513	5	7½ from the rental
there remains		£4049	4	4½ Ans.

4. If 40 men require £20 worth of bread in 10 days, when wheat is at 63s. per quarter, how long would £90 worth serve 54 men when wheat is at 56s. per quarter?

54 men : 40 men
£20 : £90
56s. : 63s.
:: 10 days : ?

$\frac{10 \text{ days} \times 40 \times 90 \times 63}{54 \times 20 \times 56} = 37\frac{1}{2}$ days. Ans.

FEMALES.

1. Make out the following bill:—

81 yds. of alpaca at 10¾d. per yd.
54 yds. of merino at 2s. 10½d. per yd.
48 yds. of linsey at 1s. 1½d. per yd.
97½ yds. of print at 8½d. per yd.
276 yds. of binding at ¾d. per yd.
22½ doz. yds. of braid at 1s. 3d. per doz.

				£	s.	d.
81 yds. at	10¾d.	per yd.	=	3	12	6¾
54 ,,	2s. 10½d.	,,	=	7	15	3
48 ,,	1s. 1½d.	,,	=	2	13	0
97½ ,,	8½d.	,,	=	3	9	0¼
276 ,,	¾d.	,,	=	0	17	3
22½ doz. at	1s. 3d.	per doz.	=	1	8	1½
				19	15	3 Ans.

2. Find the cost of 1989 articles at £38 17s. 11¾d. each.

(*a*) Cost of 1989 at £39 = £77,571 0s. 0d.

		£	s.	d.
(*b*) Cost of 1989 at £1 =		1989	0	0
,, ,, 2s. = $\frac{1}{10}$ at £1		198	18	0
,, ,, ¼d. = $\frac{1}{96}$,, 2s.		2	1	5¼
(*c*) Deduct £		200	19	5¼ from cost at £39.

£77,571 − £200 19s. 5¼d. = £77,370 0s. 6¾d. Ans.

3. What is the value of 500 acres 3 rds. 29 poles of land at one hundred guineas seventeen shillings and eightpence per acre?

		£	s.	d.
Value of 1 acre	=	105	17	8
				500
Value of 500 acres	=	52,941	13	4
,, 2 rds. = ½ val. of 1 ac.	=	52	18	10
,, 1 ,, = ½ ,, 2 rds.	=	26	9	5
,, 20 po. = ½ ,, 1 ,,	=	13	4	8½
,, 8 ,, = ½ ,, 1 ,,	=	5	5	10$\frac{8}{16}$
,, 1 ,, = ⅛ ,, 8 po.	=	0	13	2$\frac{13}{16}$
		£53,040	5	4$\frac{21}{16}$ Ans.

4. A farmer sold two lots of sheep (each lot containing the same number) for £50 10s. and £59 6s. 8d., respectively. Now the price of each sheep in the first lot was £1 5s. 3d.; find the price of each in the second lot.

£50 10s. ÷ £1 5s. 3d. = $\frac{12{,}120\text{d.}}{303\text{d.}}$
= 40 sheep.
£59 6s. 8d. ÷ 40 = £1 0s. 8d. price of each in 2nd lot.

Grammar.

1. Parse all the verbs and adjectives in the following:—

'Straight mine eye hath caught new pleasures,
While the landscape round it measures,
Russet lawns and fallows gray,
Where the nibbling flocks do stray,
Mountains on whose barren breast
The labouring clouds do often rest.'—MILTON.

Mine—pronom. poss. adj. limiting 'eye.'
hath caught—irreg. trans. verb, *catch, caught, caught*, indic. perf. def., 3rd pers. sing., agr. with subj. 'eye.'
new—adj. qual. 'pleasures.'
measures—reg. intrans. verb, indic., pres. indef., 3rd pers. sing., agr. with subj. 'it.'
russet—adj. qual. 'lawns.'
gray— ,, ,, 'fallows.'
nibbling—verbal adj. dist. 'flocks.'
do stray—reg. intrans. verb, indic., pres. indef., 3rd pers. plur., agr. with subj. 'flocks.'
barren—adj. qual. 'breast.'
labouring—verbal adj. qual. 'clouds.'
do rest—reg. intrans. verb, indic., pres. indef., 3rd pers. plur., agr. with subj. 'clouds.'

2. What does the 'Voice' of a verb show? Give examples of verbs in the different voices.

The 'Voice' of a verb shows the *relation of the subject*, or thing spoken, to the action expressed by the verb.

Transitive verbs have two voices—the Active and Passive. Since the object of the transitive verb becomes the subject of the passive voice, where there is no object there can be no change of voice. Examples:—He *struck* the ball (act.). The ball *was struck* (pass.). John *broke* the glass (act.). The glass *was broken* (pass.). Sir Garnet *defeated* Arabi (act.). Arabi *was defeated* (pass.).

3. In what three different ways is the distinction of sex of living beings marked in the nouns that stand for them? Give examples.

The distinction of sex is marked (1) By *different* corresponding *words*, as *bachelor, maid; gentleman, lady; papa, mamma.* (2) By a *difference* of *termination*, as abbot, abbess; duke, duchess; hero, heroine; widower, widow. (3) By a *distinguishing word* prefixed, as *he*-goat, *she*-goat; *man*-servant, *maid*-servant; *Mr.* Wilson, *Mrs.* Wilson; *male child, female child.*

Geography.

Answer *two* questions.

1. Write a short account of a walking tour from London through Surrey, Kent, Sussex, and Hampshire, and ending with Ryde; so arranged as to see the places of greatest interest in these counties.

Starting from London, we journey to *Kew* and *Richmond*, two pretty towns on the Thames, each having a royal palace—the former possessing the largest hothouse in England, and a fine botanic garden; the latter a splendid park. Further up the river we visit *Kingston*, where is the stone on which seven of the

Saxon kings were crowned, and near it the meadow of *Runnymede*, where King John signed the Charter. We may visit *Guildford*, the very pretty county town on the Wey, stand upon the Hog's Back among the North Downs, a great locality for mimic warfare, and hasten to *Epsom Down* to see the 'Derby' or the 'Oaks,' before we reach *Croydon*, the largest town in Surrey. Leaving this county, we pay a visit to the 'Crystal Palace' at *Sydenham*, to the 'Observatory' and 'Hospital' at *Greenwich*, to the Arsenal at *Woolwich*, and, continuing our route round the seaboard of Kent, we may visit in succession *Chatham*, *Sheerness*, *Margate*, *Ramsgate* (making a digression to see Canterbury Cathedral), *Deal*, *Dover*, and hence strike inland to see the hop-gardens around Maidstone, drink the waters at *Tunbridge*, and pass into the farming and hop-growing county of Sussex. We make our way south across the Downs past *Senlac*, the scene of the Battle of Hastings. The largest towns of Sussex being on the coast, we call in regular order at *Hastings*, *St. Leonards*, *Eastbourne*, *Brighton*—sometimes called London-on-the-Sea—and, passing *Chichester*, the only cathedral city of the county, enter Hampshire. If fond of visiting naval arsenals, our wonder will be roused by an inspection of the works at Portsmouth, and by turning our faces northwards and passing Selborne—formerly the residence of White the naturalist—we may enjoy a military review at Aldershot before prying into the nooks of old *Winchester*, once the Capital of England. We cannot fail to make ourselves acquainted with the wonderful mail-packet station of *Southampton*, and when our curiosity is gratified we can take 'the boat' down Southampton Water and across Spithead to *Ryde*, at which beautiful watering-place we can rest after our very interesting walk.

2. Name in order the Counties in the Province of Leinster, mentioning any important towns in each, and describing the character of the country.

Counties.	Chief Towns.	Character of County.
1. Louth	Dundalk, Drogheda	Smallest County. Has a rich soil, well cultivated.
2. E. Meath	Trim, Navan, Kells	Rich pastures. Supplies cattle for Dublin.
3. Dublin	Dublin, Kingstown.	Coal, marshy, & ill-cultivated.
4. Wicklow	Wicklow, Arklow, Bray	A wild region, consisting of bog, mountain and forest. Beautiful villas on coast.
5. Wexford	Wexford, Enniscorthy, New Ross	Has detached hills, with good deal of level ground. Principal crop, barley.
6. Kilkenny	Kilkenny, Thomastown	A level county—little bog—soil rich—black marble quarries.
7. Queen's County	Maryborough, Mount Mellick	Generally level—large tracts of bog - bordered by the Slieb-bloom Mountains on the West.
8. King's County	Tullamore, Parsonstown	
9. West Meath	Mullingar, Athlone	Mostly level, with many lakes bogs, and morasses. Some tracts produce oats in abundance.
10. Longford	Longford, Granard	
11. Kildare	Athy, Naas, Kildare, Maynooth	Traversed in the north by the Great Bog, also by the Royal and Grand Canals; level, and grows grain.
12. Carlow	Carlow, Tullow	Level and fertile; encompassed by mountains; produces very fine butter.

3. Describe minutely the Firths of Clyde and Forth.

The Firth of Clyde is formed by an arm of the sea which encroaches on the Lowland Plain between the Highlands and the Lowland Hills, and corresponds with the Firth of Forth on the opposite coast. This estuary is almost landlocked by the long peninsula of Cantire, gets narrower towards the north, and forms into the two sea-lochs of Loch Long and Loch Fyne, which extend into the highlands of Argyle. In this Firth lie the two large islands of Arran and Bute, and the smaller ones of Cumbrae and Holy Island.

The Firth of Forth, next to the Clyde, is the most important arm of the sea in Scotland. It lies on the east coast, forming an inlet of the German Ocean, and separates Fife on the north from the three Lothians on the south. Looking upon this Firth as the estuary of the Forth, it is about fifty miles long, has good anchorage ground, but scarcely a good harbour. There are several islands in it—May, Bass, Inchkeith, and Inchcolm. This Firth is of vast importance to British shipping, and above Queensferry it is, in every part, one of the safest roadsteads in Britain. Granton has the best harbour, while Leith is the most frequented and the only port of much commercial importance.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Egyptian*.

Write, in small hand, as a specimen of copy-setting, *Land Tenure and Agriculture in Russia.*

FIRST YEAR.

Pupil Teachers at the end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. What is the least number which leaves 4 remainder when divided either by 9, 99, 999, or 9999?

L. C. M. of 9, 99, 999, and 9999 = $9 \times 111 \times 1111 = 1109889$.

∴ the least no. to satisfy the question is $1109889 + 4 = \underline{1109893}$. Ans.

2. After payment of one-half of a debt, it is found that $\frac{4}{5}$ of what is still due is a guinea. Find the amount of the debt.

$\frac{4}{5}$ of $\frac{1}{2}$ of debt = 21s.

∴ the whole debt = $21\text{s.} \times \frac{10}{4}$

$= 112\text{s.} = \underline{£5\ 12\text{s.}}$ Ans.

3. Express ·0054 and ·093$\dot{1}\dot{8}$ as vulgar fractions; and reduce 3 hrs. 3 min. 2½ secs. to the decimal of a day.

(*a*) $\cdot0054 = \frac{54}{10000} = \underline{\frac{27}{5000}}$ Ans.

(*b*) $\cdot093\dot{1}\dot{8} = \frac{9318}{99900} = \underline{\frac{47}{480}}$ Ans.

(*c*)

60 | 2·25 sec.

60 | 3·0375 min.

24 { 4 | 3·050025 hr.

6 | ·70205025

·127109375. Ans.

4. The weight of a cubic inch of water is 253·17 grains, and that of a cubic inch of air ·310017 grains. How many cubic inches of air are equal in weight to one cubic foot of water?

No. of grains in one cubic ft. of water $= 253{\cdot}17 \times 1728$

$= 437477{\cdot}76$

∴ $437477{\cdot}76 \div {\cdot}310017 = \underline{1411141\frac{20201}{310017}}$ c. in.

FEMALES.

1. If 24 yds. 2 qrs. are required to make seven shirts, how many may be made from 13 pieces of calico, each containing 51 yds 1 qr.?

$24\frac{1}{2}$ yds. : $51\frac{1}{4}$ yds. $\times 13$ :: 7 shirts : ?

$\frac{7 \text{ shirts} \times 205 \times 13}{98} = \frac{18655}{98}$ shirts $= \underline{190\frac{75}{98}}$ shirts.

i.e., 190 shirts and 1 yd. 1 qr. remaining.

2. If a gentleman has to pay £16 3s. 4d. as income tax when 5d. in the pound, what was his annual income?

5d. : 240d. :: £16⅔ : ?

$\frac{£97 \times 240}{6 \times 5} = \underline{£776}$. Ans.

3. If eight horses are sold for £127$\frac{1}{2}$$\frac{1}{2}$, what will be the value of 15 when 4 of the former are worth 3 of the latter?

8 horses : 15 horses
3 : 4
:: £127$\frac{1}{2}$$\frac{1}{2}$:

$\frac{£5101 \times 15 \times 4}{40 \times 8 \times 3} = \underline{£318\ 16\text{s.}\ 3\text{d.}}$ Ans.

4. If a family of ten persons in 7 months spend £115, how much will a family of 12 persons spend in 6 months?

10 persons : 12 persons
7 mos. : 6 mos.
: £115 : ?

$\frac{£115 \times 12 \times 6}{10 \times 7} = \underline{£118\ 5\text{s.}\ 8\frac{4}{7}\text{d.}}$ Ans.

Grammar.

'In thy right hand lead with thee
The mountain nymph, sweet Liberty;
And, if I give thee honour *due*,
Mirth, admit me of thy crew,
To *live* with her and live with thee,
In unreproved pleasures *free*;
To hear the lark *begin* his flight,
And *singing* startle the dull night
From his watch-tower in the skies.'—MILTON.

(*a*) Point out all the prepositions in the above, and show what word each governs.
(*b*) Parse the words in italics.

(*a*) Prepositions.

In—governing	'hand.'	*with*—governing	'her.'
with— ,,	'thee.'	*with*— ,,	'thee.'
(*to*)— ,,	'thee.'	*in*— ,,	'pleasures.'
of— ,,	'crew.'	*from*— ,,	'watch-tower.
		in—governing	'skies.'

(*b*) *due*—adj. qual. 'honour.'
Mirth—abstr. noun, personified, fem. sing. nom. of address (or vocative).
live—reg. intrans. verb. infin. pres., indef. (gerundial).
free—adj. qual. pleasures.
begin—irreg. intrans. verb, *begin*, *began*, *begun*, infin. pres. indef. gov. by 'hear,' attrib. to 'lark.'
singing—incomplete part. qual. 'lark.'

2. Pronouns are divided into two main classes, substantive pronouns and adjective pronouns; mention the different kinds of substantive pronouns with examples of each.

Substantive pronouns are (1) Personal—*I*, *thou*, *we*, *ye*, or *you*. (2) Demonstrative—*he*, *she*, *it*, *they*. (3) Relative—*that*. (4) Interrogative and Relative—*who*, *what*. (5) Indefinite—*one*, *aught*, *naught*. (6) Reflective—*self* and *selves* in *myself*, *ourselves*, etc.

Geography.

Answer two Questions.

1. Draw a map of the coast-line from Dantzig to Brest. Insert the lines of latitude and longitude.

2 Give notes of a lesson on 'The Rhone.'

N.B.—*No introduction. Keep in mind, in framing the notes, that the chief object is to show how you would give the children a clear and lively view of what is to be seen along the whole course of the river, from its source to its mouth.*

Course of river to be sketched on black-board.

I. SOURCE.—Rises on the western side of Mount St. Gothard at a height of 5,780 feet. (*Read or describe Alpine scenery.*) Rhine rises in same mountain.

II. COURSE.—Flows first south-west, then bending to the N.W., enters the Lake of Geneva (*describe the lake*). After leaving the lake, turns south-west, entering a rocky gorge, when for a time it is hidden by the rocks, which nearly meet over the stream—flows south, then bends to the N.W., is joined by the Saone at Lyons, and then flows south to the Mediterranean, which it enters by four mouths, forming a delta (*explain*).

III. CHARACTER OF RIVER.—Owing to its rapidity, the Rhone was long of no commercial value, but since steamers have been introduced, great progress has been made. It is connected by canals with the principal rivers of France. From Lyons it flows through a valley, whose slopes are almost everywhere planted with vines, forming some of the finest vineyards of France. It traverses very beautiful districts, well adapted for the cultivation of the mulberry, and this causes the Rhone valley to be the best silk-producing portion of France.

IV. TOWNS ON BANKS.—*Martigny*, near the great road over Great St. Bernard. *Chillon*, with famous castle, made famous by Byron's 'Prisoner of Chillon.' *Lausanne*, where Gibbon resided. *Geneva* (describe town and lake). *Lyons*, silk manufacture, greatest in Europe. *Vienne*, in a beautiful region.

History.

1. Write out a list of our sovereigns from 800 to 901, with dates.

	A.D.
Egbert, Bretwalda	800
,, King of England	827
Æthelwulf ,, ...	837
Æthelbald ,, ...	858
Æthelbert ,, ...	860
Æthelred ,, ...	866
Alfred ,, ...	871
Edward the Elder,, ...	901

2. What sovereigns reigned between Henry I. and Edward I.? Give their dates.

		A.D.		
Stephen	began to reign	1135	died	1154
Henry II.	,,	1154	,,	1189
Richard	,,	1189	,,	1199
John	,,	1199	,,	1216
Henry III.	,,	1216	,,	1272

3. Name our sovereigns between 1660 and 1760, and give their dates.

		A.D.
Charles II.	restored ...	1660
James II.	succeeded ...	1685 dethroned 1688
William III. Mary II.	,, ...	1689
Anne	,, ...	1702
George I.	,, ...	1714
George II.	,, ...	1727
George III.	,, ...	1760

Composition.

Write from memory the substance of the passage read by the inspector.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Egyptian*.

Write in small hand, as a specimen of copy-setting, *Land Tenure and Agriculture in Russia.*

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the interest of £671 19s. 6d. for three months at $4\frac{1}{2}$ per cent. per annum, simple interest.

$$\text{Interest} = £671\ 19s.\ 6d. \times \tfrac{1}{4} \times \frac{4\frac{1}{2}}{100}$$
$$= \frac{£755\ 19s.\ 5\frac{1}{2}d.}{100} = £7\ 11s.\ 2\tfrac{11}{200}d. \quad \text{Ans.}$$

2. An auctioneer's bill for the sale of goods was £58 1s. 3d. His charge for commission was 6 per cent.; what was the value of the goods sold?

$$£6 : £58\tfrac{1}{16} :: £100 : \text{amount sold.}$$
$$\frac{£100 \times 929}{6 \times 16} = \frac{£92900}{96} = £967\ 14s.\ 2d. \quad \text{Ans.}$$

3. The interest on £383 6s. 8d. at 6 per cent. per annum is £9 4s. For what time was the money lent?

$$\left.\begin{matrix} £383\frac{1}{3} : & £100 \\ £6 : & £9\frac{1}{3} \end{matrix}\right\} :: 12 \text{ mos.} : \text{time.}$$
$$\frac{12 \text{ mos.} \times 100 \times 3 \times 46}{1150 \times 6 \times 5} = \tfrac{24}{5} \text{ mos.} = 4\tfrac{4}{5} \text{ mos.} \quad \text{Ans.}$$

4. In 1879 the number of elementary schools in England and Wales was 17,325, containing 2,647,525 children in average attendance. In 1880 the number of schools was 17,743, containing 2,796,985 children. Find the increase per cent. in the number of schools and in the average attendance.

(*a*) $17,743 - 17,325 = 418$ schools.
$17,325 : 100 :: 418 : \text{increase p. c.}$
$$\frac{41,800}{17,325} = 2{\cdot}41. \quad \text{Ans.}$$

(*b*) $2,796,985 - 2,647,525 = 149,460$ children.
$\therefore 2,647,525 : 100 :: 149,460 : \text{increase p. c.}$
$$\frac{14,946,000}{2,647,525} = 5{\cdot}64. \quad \text{Ans.}$$

FEMALES.

1. Reduce the expression $\left(\frac{3\frac{1}{2}}{7}+\frac{2}{10\frac{1}{2}}-\frac{8}{15}\text{ of }\frac{5}{7}\right)\times 1\frac{3}{4}$ to its simplest form.

$$\left(\frac{10\times 4}{21}-\frac{20}{126}\right)\times\frac{7}{4}=\frac{42-10}{63}\times\frac{7}{4}$$
$$=\frac{32\times 7}{63\times 4}=\frac{8}{36}. \text{ Ans.}$$

2. Simplify $\frac{3}{7}\text{ of }\frac{5}{9}\text{ of }\frac{35}{4}$ and take the result from the sum of $\frac{3}{7}\text{ of }\frac{7}{8}\text{ of }\frac{64}{81}$ $10\frac{3}{10}$, $3\frac{8}{10}$, $7\frac{3}{100}$.

(*b*) $10\frac{3}{10}+3\frac{8}{10}+7\frac{3}{100}=20\frac{75+90+96}{100}=22\frac{61}{100}$

(*a*) $\frac{3}{7}\text{ of }\frac{5}{9}\text{ of }\frac{56}{81}=\frac{2\times 5\times 35\times 7\times 3\times 81}{3\times 7\times\ 9\times 1\times 2\times 84}=18\frac{3}{4}=\frac{18\frac{75}{100}}{3\frac{11}{22}}$ Ans.

3. Standard gold contains 12 parts of pure gold to one part of copper, and 20 lbs. Troy are coined into 934 sovereigns and a half-sovereign; find the weight of pure gold in a sovereign.

13 parts : 12 parts :: $\frac{115200\text{ grs.}}{934\frac{1}{2}}$: weight of pure gold in a sov.

$$\frac{115200\text{ grs.}\times 12\times 2}{13\times 1869}=\frac{2764800}{24297}\text{ grs.}=\underline{113\frac{4419}{8099}\text{ grs.}}\text{ Ans.}$$

Grammar.

1.

'O sweet and strange it seems to me that ere this day is done,
The voice that now is speaking may be beyond the sun.'
TENNYSON.

(*a*) Point out the conjunctions in the above, and assign each to its proper class.

(*b*) Parse the verbs in the above passage.

(*a*) *And*—copulative co-ordinate conj.
that—subordinating ,,
ere—subord. temporal ,,

(*b*) *seems*—reg. intrans. verb, indic., pres. indef., 3rd pers. sing., agr. with subject 'it.'
is—irreg. intrans. verb, *am, was, been*, indic., pres. indef., agr. with subj. 'day.'
done—complete part. of *do, did, done*, used predicatively, qual. 'day.'
is speaking—irreg. intrans. verb, *speak, spoke, spoken*, indic., pres., progressive, 3rd pers. sing., agr. with subj. 'that.'
may—irreg. defec. verb, *may, might*, indic., pres. indef., forming with the infinitive.
be—3rd pers. sing., pres., pot., and agrees with subj. 'voice.'

2. Explain clearly the words 'subject,' 'predicate,' 'object,' 'extension of predicate,' and 'enlargement of subject.' Give examples of each.

(1) The *subject* is one of the essential parts of a sentence, and denotes that which is spoken about: as, *John* reads; *to be good* is to be happy; *working* often fatigues us.

(2) The *predicate* is the other essential part of a sentence, and denotes what is affirmed of the subject, as: 'reads,' 'is to be happy,' and 'often fatigues us,' from the examples in (1).

(3) The *object* is the completion of the transitive verb, and stands for the object of the action described by the verb, as: he struck *the ball;* he wrote *a letter;* they made *a noise.*

(4) The 'extension of predicate' consists of an adverb or a word or phrase equivalent to an adverb expressing some circumstance of place, time, degree, certainty, or uncertainty, manner, etc., connected with the action, as: We met *in the town;* it happened *long ago;* it concerns us *little;* he died *of fever.*

(5) The 'enlargement of the subject' is an adjective, or some word or phrase equivalent to an adjective, qualifying, limiting, or distinguishing the subject, as: *Much* anxiety shortens life; *his* death was lamented; Havelock, *the Christian soldier*, died in India.

Geography.

Answer Q. 1 or Q. 2; not both.

1. Give notes of a lesson on 'New Zealand.' Illustrate by a map, and insert the lines of latitude and longitude.

N.B.—*No introduction. Keep in mind that the chief object is to give the children a clear and lively view of the appearance and character of the country and its inhabitants.*

Notes of a lesson on 'NEW ZEALAND.'

I. APPEARANCE AND CHARACTER OF THE COUNTRY.—Antipodes of England (explain *antipodes*)—consists of three islands—compare with United Kingdom—North Island somewhat larger than Ireland—South Island somewhat larger than England and Wales—Stewart Island about the size of Westmoreland—from position the climate is mild, and, on account of surrounding ocean, the temperature is of an even character—North Island has perpetual spring—which genial temperature makes it a pleasant residence—South Island traversed by a range of mountains called Alps, which arrest the moisture of the westerly winds.—The forests abound in good timber, and, owing to the greenness of the tree-ferns, are extremely beautiful.—Gold is found on the western side of the mountains—iron in the west of North Island—hot-water springs are found here and there in volcanic regions—coal and copper in many parts of both islands—flax is grown and exported—chief exports, however, are gold and wool—New Zealand has no large rivers—the largest and most thriving settlement is a Scotch one, whose capital is Dunedin, at the head of a fine harbour in the south-east of South Island.

II. INHABITANTS.—The aborigines, or original natives of New Zealand, are called Maories, and are of the Malay race. They are more intelligent and capable of civilization than any other race of savages—have fixed dwellings—cultivate the land—learn trades—and embrace the Christian religion. When Captain Cook visited the Islands about a hundred years ago they thought that his ship was a bird of unusual size, and admired its sails, which they took to be wings.

2. What articles in common use are imported from British Colonies? Explain in each case, as you would to children, why we cannot supply our wants by what can be produced at home.

The articles in common use imported from the Colonies are sugar, rum, which are obtained from the sugar-cane, a plant requiring a tropical climate, that is, one very much warmer than we have in Britain. For a similar reason tea, the leaf of a plant grown in the East Indies, has to be imported; as also cotton, the downy fruit of the cotton-plant; tobacco, the leaf of the tobacco-plant; and coffee, the berry of the coffee-plant, from our colonies in the West Indies. Mahogany, logwood, and indigo are also only grown under a very warm sun, and hence have to be brought to us. We cannot grow enough of wheat to supply us with sufficient bread, so Canada and Australia provide us with it. The latter also sends us beef and mutton. From Cape Colony and Australia come wine and wool, and Guiana gives us pepper. From what has been said it is easily inferred that when, in the mother country, from certain circumstances a scarcity of the necessaries of life occurs, we have only to send a message to our farmers and planters across the seas to send us what we lack.

SECOND PAPER.

Two hours and a half allowed.

History.

1. At what periods was this country invaded from Italy, Germany, Denmark, and France?

This country was invaded by the Romans under Julius Cæsar in 55 B.C., but it was not till the time of the Emperor Claudius, who came over in A.D. 43, that the Romans began really to conquer Britain.

In the fourth century, when the power of Rome was going down, the Celts of the North began to pour into Roman Britain, and the island was attacked by certain Teutonic tribes who came from the mouths of the Elbe and Weser, in North Germany. According to ancient tradition, the first Teutonic kingdom was founded by Hengist and Horsa, who landed at Ebbsfleet, in Thanet, 449, at the invitation of Vortigern, a British prince.

During the reign of Egbert (800–837) the Scandinavian or Danish pirates began to trouble the island. Under his grandson, Æthelred I., began the great Danish Wars, and during the reign of Alfred the Danes had established themselves in Mercia and the North. In 878, so completely did they defeat the British, that Alfred had to flee in disguise. Finally, in 1013, all England submitted to the Danish king Sweyn.

In 1066 the Normans, under Duke William, invaded England to wrest from Harold II. the crown, which he was said to have usurped. By the victory at Senlac England was laid at the mercy of William, who was crowned on Christmas-day, 1066.

2. Sketch the character and career of William II. or Stephen.

Stephen succeeded Henry I. on the throne of England. On Henry's death he was proclaimed by his partisans, accepted by

the nation, and confirmed by the Pope. But attempts on behalf of Henry's daughter Matilda, Countess of Anjou, soon commenced in Normandy, in the North of England by David of Scotland, in Wales, and gradually in all parts of England. One of these arose as fast as the other was quelled, and the Scots twice invaded England, the second time being defeated at the 'Battle of the Standard.' Stephen's attempt to curb the power of the clergy raised the whole ecclesiastical power of the country against him. Before his efforts to compromise matters were carried through Matilda again invaded England, and after four months' war Stephen was taken prisoner and confined in Bristol Castle. A short time elapsed before Stephen's queen found an opportunity of attacking the victorious party; and, in the end, Stephen was released, and the war, with various fortunes, carried on till Matilda was forced to leave the country. This struggle over, others rose into importance, and ere Stephen had succeeded in reducing his rebellious vassals, the son of his old enemy invaded England, and war was once more preparing. But an arrangement was come to by which Henry, Matilda's son, was declared Stephen's successor. For about a year longer Stephen held the throne and died 1154.

Stephen has been considered a noble specimen of the feudal lords of his time. His bravery was never tainted with cruelty, and the rage of civil war never made him implacable or ungenerous. He was imprudent, but he could gain and keep men's esteem, and the greatest blot upon his name is the ambition which brought upon the land, for fourteen years, misery and desolation.

3. What was the position of the barons in the time of Edward II.? and what was their conduct?

On account of Edward's weakness for a worthless favourite named Piers Gaveston, the barons took up a position inimical to him, and demanded the banishment of the minion. The king unwillingly yielded, but soon the favourite was brought back. The barons and others appointed the 'Ordainers' to reform the government, and again Piers was banished. Again he returned, but the barons, taking up arms, obliged him to surrender in Scarborough Castle, and he was beheaded on Blacklow Hill.

While Edward was wrangling with his barons, Scotland was preparing for the struggle for that independence which was won at Bannockburn. On Edward's return from defeat in Scotland he once more gave himself up to favourites, and the barons, assisted by the queen herself, took common cause against the king; who, captured in Glamorgan, was imprisoned in Berkeley Castle, where he was secretly murdered, 1327.

Composition.

Write full notes of a lesson on *the oak.*

ARTICLES TO BE SEEN.—*Oak-leaf—oak-bark—piece of trunk—acorn—untanned leather—tanned leather—picture of tree, for children who cannot see the real thing.*

DESCRIPTION.—Noble object in a landscape—king of trees—long-lived—of great size—stands the storm—roots firm in the ground, and go a great depth—grows naturally in England—two kinds—one less firm and durable—the other has wood tough, hard, durable, no insect can pierce it—age known by counting the rings in trunk (*explain why*)—gall nuts found on leaves—oak tree best cut when it is over seventy or eighty years of age—fruit called acorns.

WHERE FOUND.—Grown in England, in forests belonging to the Crown—common in Spain, France, Portugal, Russia, Norway, Sweden, Scotland, Canada, India, etc. The English forests are—New Forest, Epping, Dean, and Sherwood.

USES.—Used wherever strength and durability are required—especially for ships—for furniture, carvings in churches, for roofs—all old buildings have oak-roofs. *Oak-sawdust* used as one of the chief ingredients in dyeing the different shades of brown and drab colour. *Oak-bark* employed for tanning leather, for fuel and manure. *Acorns* used for feeding pigs; formerly eaten by the peasantry of this country, and still eaten in Spain and Asia Minor. *Gall-nuts* used in dyeing black.

HISTORICAL NOTES.—Venerated by the Druids—William Rufus met his death by an arrow glancing from an oak—Charles II. concealed himself in an oak at Boscobel.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Egyptian.*

Write, in small hand, as a specimen of copy-setting, *Land Tenure and Agriculture in Russia.*

Euclid.

MALES.

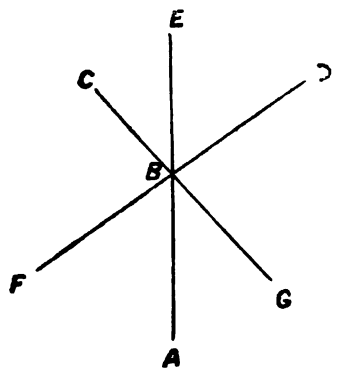
(All generally understood abbreviations for *words* may be used.)

1. To bisect a given finite straight line, that is, to divide it into two equal parts.

Prop. 10, Book I.

2. Prove by means of the 15th proposition that all the angles made by any number of lines, meeting at one point, are together equal to four right angles.

Let the three straight lines AB, BC, BD, meet at the point B, the angles ABC, CBD, DBA, shall be equal to four right angles.



Produce AB, CB, and DB, to E, G, and F respectively. Then by I. 15, the opposite vertical angles made by the straight lines cutting each other are equal, that is, the angles ABF, FBC, CBE, on one side of AE, are equal to EBD, DBG, GBA on the other; and by the 13th proposition ABF, FBE, or ABF, FBC, CBE, are equal to two right angles; and for the same reason the three angles on the other side of AE are equal to two right angles. Therefore the angles made by ABC, CBD, DBA, are equal to four right angles. Hence it is evident that though a great number of angles be made by lines meeting in the same point, yet the four original right angles are sub-divided, but neither increased nor diminished.

3. At a given point in a given straight line, to make a rectilineal angle equal to a given rectilineal angle.

Prop. 23, Book I.

Needlework.

FEMALES.

One hour allowed for this exercise.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. If 25 francs are worth a sovereign, what will a person lose who receives payment of a debt of £16 5s. in francs valued at 9$\frac{3}{4}$d. each.

$$\frac{£16\ 5s.}{9\frac{3}{4}d.} = \frac{15,600}{39} = 400 \text{ francs.}$$

400 fr. at 25 fr. per £ = £16 ∴ he loses 5s. Ans.

2. A man bought 296 sheep at £1 7s. 6d. each, and after paying $\frac{3}{11}$ of his outlay for their keep exchanged them for 37 cows, which he sold at £15 per head. What did he gain per cent.?

$$(£1\tfrac{1}{8} + \tfrac{3}{11} \text{ of } £1\tfrac{1}{8}) \times 296 = £1\tfrac{1}{2} \times 296 = £481$$

37 cows at £15 each = £555

∴ the profit on £481 is 74

481 : 74 :: 100 : gain p.c.

$\frac{7400}{481} = 15\frac{5}{481}$. Ans

3. Find the difference between the present worth and the nominal value of a bill for £3152 13s. 5½d. drawn October 13th at 4 months, and discounted December 5th at 5 per cent.

(*a*) The bill is due on the 16th Feb. of ensuing year.

From Dec. 5th till Feb. 16th there are 73 days, including days of grace.

$$365:\ 73 :: £5 : £1 \text{ interest on } £100.$$
$$\therefore 101 : 100 :: £3152\ 13s.\ 5\tfrac{1}{2}d. : \text{pres. val.}$$
$$£3152\ 13s.\ 5\tfrac{1}{2}d. \times \tfrac{100}{101} = £3121\ 9s.\ 2d.$$

(*b*) Interest $= \frac{£3152\ 13s.\ 5\frac{1}{2}d. \times \frac{73}{365} \times \frac{5}{100}}{100} =$
$= £31\ 10s.\ 6\tfrac{83}{100}d.$

$\therefore$ Nominal value
$= £3152\ 13s.\ 5\tfrac{1}{2}d. - £31\ 10s.\ 6\tfrac{83}{100}d. = £3120\ 2s.\ 10\tfrac{17}{100}d.$
$\therefore$ the diff. bet. pres. val and nominal $=$ £1 6s. $3\tfrac{183}{400}$d. Ans.

4. The three per cents. are at 84, and a 4 per cent. stock at 98. If a man has £1000 to invest, what will be the difference in his income according as he purchases the one or the other?

		£	s.	d.
1st income	$= \frac{3}{84}$ of £1000 $=$	35	14	$3\frac{3}{7}$
2nd ,,	$= \frac{4}{98}$,, $=$	40	16	$3\frac{4}{49}$
diff. of income $=$		5	1	$11\frac{33}{49}$. Ans.

FEMALES.

1. Divide ·011214 by 53·4, and 1121·4 by ·534.

(*a*)
$$53{\cdot}4 \overline{)\ {\cdot}011214\ (\ {\cdot}00021} \text{ Ans.}$$
$$1068$$
$$534$$
$$534$$

(*b*)
$${\cdot}534 \overline{)\ 1121{\cdot}4\ (\ 2100} \text{ Ans.}$$
$$1068$$
$$534$$
$$534$$

2. Simplify, expressing each result in a fractional and decimal form—

$$(a)\ \frac{{\cdot}015 \times 2{\cdot}1}{{\cdot}035}; \qquad (b)\ \frac{3\frac{1}{2} - {\cdot}04}{5 - {\cdot}0625}$$

$$(a)\ \frac{{\cdot}015 \times 2{\cdot}1}{{\cdot}035} = \frac{15 \times 21 \times 1000}{1000 \times 10 \times 35} = \frac{9}{10} \text{ or } {\cdot}9. \text{ Ans.}$$

$$(b)\ \frac{3\frac{1}{2} - {\cdot}04}{5 - {\cdot}0625} = \frac{3{\cdot}46}{4{\cdot}9375} = \frac{34600}{49375} = \frac{1384}{1975} \text{ or } {\cdot}70075949367. \text{ Ans.}$$

3. Add 5½ cwt. to 3·125 qrs., and reduce the sum to the decimal of a ton.

$$5\tfrac{1}{2} \text{ cwt.} = 22 \text{ qrs.}$$
$$+3{\cdot}125 \text{ qrs.} = 3{\cdot}125$$
$$= 25{\cdot}125 \text{ qrs.}$$
$$4 \mid 25{\cdot}125 \text{ qrs.}$$
$$20 \mid 6{\cdot}28125 \text{ cwt.}$$
$${\cdot}3140625 \text{ ton. Ans.}$$

Grammar.

1. 'Mortals that would follow me,
Love virtue; she alone is free:
She can teach ye how to climb
Higher than the sphery chime;
Or, if virtue feeble were,
Heaven itself would stoop to her.'—MILTON.

(*a*) Analyse the subordinate sentences in the above, stating to which class each belongs.

(*b*) What is meant by the mood of verbs? Give examples of verbs in the imperative, subjunctive, and infinitive moods from the above.

(*c*) Give the sense of the above passage in simple prose language.

(*a*) (1) '*that would follow me*,' subord. adj. sent. attrib. to 'mortals.'
that .....subject.
would follow.....predicate.
me .....object.
(2) '*if virtue feeble were*,' subord. adv. sent. of condition.
if.....connective.
virtue.....subject.
were .....incomplete predicate.
feeble .....completion of ,,
(3) '*than the sphery chime* (is high),' subord. adv. sent. of degree.
than .....connective.
the sphery .....enlargement of subject.
chime.....subject.
(*is high*) .....predicate.

(*b*) By the mood of verbs is meant the variation of form, by means of which we can show to the mind the mood or manner in which the action or fact denoted by the verb is connected in our thoughts with the thing that is spoken of.

From the above 'love' is an example of the imperative (or commanding mood); 'were' of the subjunctive (or mood of conception); and 'to climb' of the infinitive (or mood unlimited by person, number, or time).

(*c*) Those who wish to be my followers must lead a life of virtue, for that alone is the life of true liberty. If virtue was not powerful enough to carry us to a land beyond the sky, heaven itself would come down to assist virtue.

2. Give the meaning of the Latin prefixes *ad*, *dis*, *sub*, and show by examples how the spelling of these words is sometimes changed in composition.

Ad means 'to,' and in composition becomes *ac*, *af*, *ag*, *al*, *an*, *ap*, *ar*, *as*, *at*; as, *a*ddress, *ac*cede, *af*fect, *ag*grieve, *al*lege, *an*nex, *ap*pend, *ar*rest, *as*sent.

Dis (asunder) becomes *di*, *dif*, *de*; as, *dis*tend, *di*verge, *dif*fer, *de*luge.

Sub (under, after) becomes *suc*, *suf*, *sug*, *sum*, *sup*, *sur*, *sus*; as, *sub*merge, *suc*ceed, *suf*fice, *sug*gest, *sum*mon, *sup*pose, *sur*mount, *sus*pend.

Geography.

Answer either Q. 2 or Q. 3, not both.

1. Draw a full map of Egypt, Arabia, and the Isthmus of Suez. Insert the lines of latitude and longitude.

2. Give notes of a lesson on 'The Caspian Sea.'

Notes on the 'CASPIAN SEA.'

Sketch of the Caspian to be made on the blackboard.

Position—Lies on south-eastern boundary of Europe—Caucasia on western—Persia on southern shore—Russia on north and east.

Character—a vast salt-water lake—largest strictly inland expanse of water in the world—called a 'sea' by the ancients, who thought it a part of the Northern Ocean—remarkable from its surface being below the general level of the waters of the globe, and having no outlet.

Extent—640 miles long—from 100 to 200 miles broad—covers an area of from 130,000 to 180,000 sq. miles.

Feeders—principal rivers running into it—the *Volga* (2,200 miles), longest of European rivers—the *Ural* (1,150 miles), *Terek* (300 miles), *Kour* (550 miles), and the *Atrek*.

How surplus water is got rid of—supply of rain and river water seems to be exactly equal to the amount evaporated—were this not the case an alteration of level would be the result—present level remains unchanged.

Note—the Caspian Sea *has no tides*—waters are moderately salt—it is shallow—stormy—of difficult navigation—and has a few indifferent ports.

3. A prisoner in Siberia made his escape, and travelled across the continent to Calcutta. Describe his journey.

Supposing him to have reached Kiakhta, or one of the trading towns on the frontiers of Siberia, he might join one of the caravans returning from that town to Kashgar or Yarkand, in Eastern Turkestan. To reach either of these the caravan would travel through the Great Desert of Shamo, in Mongolia. From Yarkand, whose bazaars are crowded with merchants from every country in Asia, he could make his way to Iltchi, the capital of Kotan, then taking advantage of a pass in the Kuen Lun, and crossing the valley enter Kashmir through one of the passes in the Karakorum Mnts. Being now in British terri-

tory he might rest after his travels in the Vale of Kashmir, and then following the route of the proposed railway from Jhelam to Lahur. At Lahur he could take the railway, and on the journey pass Delhi, Agra, Kanhpur (Cawnpore, Allahabad, Benares, Patna, Chandernagore (belonging to France), and Serampoor.

SECOND PAPER.

Two hours and a half allowed.

History.

1. When and how did the House of Tudor obtain the throne?

By the defeat and death of Richard III. at Bosworth, in 1485; the victor, Henry Tudor, Earl of Richmond, was crowned king by Lord Stanley on the field of battle. Henry VII. was the first of the Tudor dynasty, and by his marriage with Elizabeth of York, he represented the two rival houses, for he himself was a Lancastrian, and thus he brought about the Union of the Roses.

2. Show that the power of the Commons was gaining strength under James I.

In 1604 James was reminded by the Commons that he was a limited monarch, and that every Bill must pass the two Houses before it could be submitted to him, and that new laws could not be made nor old ones abolished by any other power than by the agreement of Commons, Lords, and sovereign. In the same year they established their right to decide contested elections, and they presented an Apology to the king regarding their privileges. The object of the Apology was to put on record a protest against misinformation delivered to his majesty, and to assert the Constitutional rights and liberties of Parliament. They maintained that they held these privileges of right and not of grace; that they were not a court of record; and that the examination of writs was without their compass, and belonged to chancery.

The Commons, generally so tame in the early Tudor period, gradually gathered courage, and before it closed were awake to their duties and power. The absolute tendency of James I. and his absurd theory of 'divine right,' led the Commons to take a very decided tone.

3. What European nations aided the American colonies in the War of Independence? Explain the perilous condition of England at that time.

The Americans were directly aided by the French in men and money. Indirectly they were assisted by the European nations that were at war with England during the latter years of the American war. Besides France, Spain and Holland were in arms against her. Russia, Sweden, and Denmark formed an armed neutrality which meant that when an opportunity offered they would join her more active and aggressive neighbours. Notwithstanding these fearful odds against her, England, as all the world knows, finally triumphed.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Egyptian*.

Write, in small hand, as a specimen of copy-setting, *Land Tenure and Agriculture in Russia.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

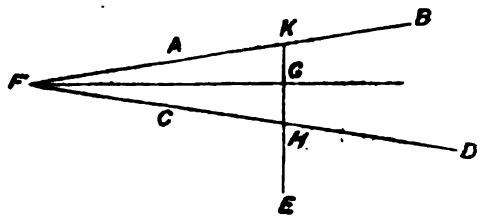
Answer two Questions, including Q. 1, if you can.

[All generally understood abbreviations for *words* may be used.]

1. From a given point draw a line making equal angles with two given lines.

Let AB, CD be the two given lines, and E the given point, then if AB, CD be parallel any straight line drawn from E to meet AB, CD perpendicularly will make equal angles with them; but if not, let them be produced to meet in F.

Bisect the angle BFD by the straight line FG.



From E draw EHG perpendicular to FG, and produce it to meet FB in K. EHK shall make equal angles with AB, CD, that is FB, FD. The angles KFG, HFG are equal by construction, and the angles at G right angles. The side FG is also common to the two triangles KFG, HFG. ∴ the two triangles (I. 26) are equal in every respect, and therefore the angle FKG is equal to FHG. That is, HK makes equal angles with FB, FD. (Q.E.F.) If the point E lie between the lines, produce EG both ways to R and H.

2. If a straight line fall upon two parallel straight lines, it makes the alternate angles equal to one another; and the exterior angle equal to the interior and opposite upon the same side; and likewise the two interior angles upon the same side together equal to two right angles.

Prop. 29, Bk. I.

3. Equal triangles upon the same base and upon the same side of it are between the same parallels.

Prop. 39, Bk. I.

Algebra.

MALES.

1. Prove that $a \times a^n = a^{m+n}$; m and n being any positive whole numbers.

Resolve $x^2 - 3x + 2$ into factors.

(*a*) Since a^2 is the same as $a \times a$
and a^3 is the same as $a \times a \times a$
then $a^3 \times a^2 = (a \times a \times a) \times (a \times a)$
$= a \times a \times a \times a \times a$
$= a^5$ according to usual definition respecting indices,
$= a^{3+2}$

Similarly $a \times a^n = a \times a$ ..... to m factors $\times a \times a$.....to n factors,
$= a \times a$.....to $(m+n)$ factors,
$= a^{m+n}$ according to usual definition respecting indices. Q.E.D.

(*b*) $x^2 - 3x + 2 = \underline{(x-1)(x-2)}$. Ans.

2. Find the L. C. M. of $6(a^2b - ab^2)$ and $16(a^3 - b^3)$.

Their G. C. M. $= 2(a - b)$

∴ ,, L. C. M. $= \dfrac{6(a^2b - ab^2) \times 16(a^3 - b^3)}{2(a-b)}$

$= 3ab \times 16(a^3 - b^3)$

$= \underline{48ab(a^3 - b^3)}$ Ans.

3. Solve the equations:—

(1) $\dfrac{3x-7}{14} - \dfrac{17x-5}{85} = \dfrac{5x-7}{35}$

(2) $\dfrac{1}{6-x} - \dfrac{1}{7-x} = \dfrac{1}{x^2}$

(1) Clearing of fractions $255x - 595 - 238x + 70 = 170x - 238$

$255x - 238x - 170x = 595 - 70 - 238$

$153x = -287$

$x = \underline{-1\frac{134}{153}}$. Ans.

(2) Clearing of fractions $7x^2 - x^3 - 6x^2 + x^3 = 42 - 13x + x^2$

Collecting $13x = 42$

$x = \underline{3\frac{3}{13}}$. Ans.

Needlework.

FEMALES.

One hour allowed for this Exercise.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after, 1st May,* **1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. The sum of 11s. 1½d. was divided among four persons in the ratios of ½, ⅓, ¼, ⅕. What was the share of each?

$\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{168+140+120+105}{840}=\frac{533}{840}$ sum of shares.

$\therefore \frac{533}{840}:\left\{\begin{matrix}\frac{1}{2}\\ \frac{1}{3}\\ \frac{1}{4}\\ \frac{1}{5}\end{matrix}\right\}::$ 11s. 1½d. $:\left\{\begin{matrix}3s.\ 6d. & \text{1st. Ans.}\\ 2s.\ 11d. & \text{2nd. Ans.}\\ 2s.\ 6d. & \text{3rd. Ans.}\\ 2s.\ 2\frac{1}{2}d. & \text{4th. Ans.}\end{matrix}\right.$

2. What ought to be the price of £100 of bank stock which pays a dividend of 10½ per cent. in order that it may pay 4½ per cent. on the money invested?

£4½ : £10½ :: £100 : price of stock.

$£\frac{100\times 21}{9}=$ £233 6s. 8d. Ans.

3. If I lend a sum of money to a friend at 4¾ per cent. simple interest, and he return me £877 12s. 6d. at the end of four years, what is the amount of the loan?

Amount of £100 for 4 years at 4¾ per cent. = £119.

∴ 119 : 100 :: £877½ : amount of loan.

$£\frac{7021\times 100}{8\times 119}=$ £737 10s. Ans.

4. A sells goods to B for £115 19s. 2d. and gains 10 per cent. on the price he originally paid for them. B sells the same goods again, and loses 10 per cent. At what price did A buy the goods, and at what price did B sell them?

(*a*) £110 : 100 :: £115 19s. 2d. : price A paid.

$£\frac{115\ 19s.\ 2d.\times 100}{110}=$ £105 8s. 4d. Ans.

(*b*) £100 : £90 :: £115 19s. 2d. : B's selling price.

$£\frac{115\ 19s.\ 2d.\times 90}{100}=$ £104 6s. 3d. Ans.

FEMALES.

1. Find the simple interest and the amount of £106 13s. 4d. from June 15, 1882, to September 18, 1882, at 4½ per cent.?

No. of days from June 15th to Sept. 18th
$=15+31+31+18=95.$

$\text{Interest}=£106\frac{2}{3}\times\frac{95}{365}\times\frac{4\frac{1}{2}}{100}$

$=£\frac{320\times 95\times 9}{3\times 365\times 200}$

$=£\frac{342}{365}=$ £1 4s. 11$\frac{2}{73}$d. Ans.

∴ Amount = £106 13s. 4d. + £1 4s. 11$\frac{2}{73}$d. = £107 18s. 3$\frac{2}{73}$d.

2. If four men can earn £15 in 20 days, how many men will earn 10 guineas in 7 days?

$\left.\begin{matrix}£15 : £10\frac{1}{2}\\ 7\text{ days} : 20\text{ days}\end{matrix}\right\}::4\text{ men}:?$

$\frac{4\text{ men}\times 10\frac{1}{2}\times 20}{15\times 7}=$ 8 men. Ans.

3. If 3·75 yards of cloth cost £3·825, what will 38 yards, 2 qrs. 3 nails cost?

3¾ yards : 38$\frac{11}{16}$ yards :: £3·825 : ?

$\frac{£3\cdot 825\times 619}{60}=\frac{£2367\cdot 675}{60}=$ £39·46125

$=$ £39 0s. 2$\frac{7}{16}$d. Ans.

4. A alone can reap a field in 5 days, and B in 6 days, working 11 hours a day; find in what time A and B can reap it together, working 10 hours a day?

A and B do ⅕+⅙ or $\frac{11}{30}$ in a day of 11 hours.
That is $\frac{1}{30}$ per hour. ∴ working 10 hours together, they do $\frac{1}{30}\times 10=\frac{1}{3}$ in a day of 10 hours, or the whole in 3 days. Ans.

Grammar.

1. '*Seeke* the good of *others*, but *be* not in bondage to their faces or fancies; for *that* is *but facilitie* or softness; *which* taketh an honest minde *prisoner*. Neither give thou Æsop's cock a gemme who would be *better pleased*, and happier if he had *had* a barley-corne.'—BACON.

(*a*) Give an example from the above of a compound and of a complex sentence, and define what a compound and what a complex sentence is.
(*b*) Parse the words in italics.
(*c*) To what 'period' of the English language does the above passage belong? Notice any points in which it differs from the English now in use?

(*a*) (1) 'Seeke the good of others, but be not in bondage to their faces or fancies,' is a compound sentence. 'Neither give thou Æsop's cock a gemme who would be better pleased if he had had a barley-corne,' is a complex sentence.

(2) A compound sentence is composed of two or more co-ordinate principal sentences.

A complex sentence while containing but one principal subject, and one principal predicate, has two or more finite verbs.

(*b*) *Seeke*—irreg. trans. verb, *seek, sought, sought*, imper. pres. indef., 2nd pers. sing. agr. with subj. (*thou.*)
others—indef. pron., com., plur., obj., gov. by 'of.'
be—irreg. intrans. verb., *am, was, been*, imper., pres. indef., 2nd pers. sing., agr. with (thou.)
that—demonst. adj. pron., 3rd pers. sing., neut., nom., subj. of 'is.'
but—adv. mod. 'is.'
facilitie—abstr. noun, neut. sing. nom., after 'is.'
which—simple rel. pron., 3rd pers. sing. nom., subj. of 'taketh.'
prisoner—com. noun. neut. sing., obj. by 'taketh.'
better—adv. comp. deg., mod. 'pleased.'
pleased—complete part. of reg. verb. *please*, qual. 'who.'
had—complete part. of irreg. verb, *have, had, had*, forming with 'had' the pluperf. indic.

(*c*) The passage belongs to that period of English Literature called the 'Age of Elizabeth' (1575-1616). It differs from the English of the present time in idiom, spelling, and style. *Seeke, minde, corne*, are now spelt without the final *e*, *facilitie* is spelt with *y* instead of *ie*, and is never used now in the same sense as in the above. *Gemme* has lost the final *me*, and we would consider 'who' too far from its antecedent. Modern English would have made the arrangement much less stiff, much simpler and clearer.

2. What are the Latin words from which the following names of places are derived:—Chester, Stratford, Fossbury? Give the meaning of each Latin word, and mention any other names of places (that may occur to you) which are derived from the same.

From *castra* (a camp) come Chester, Lancaster, Worcester, Leicester.

From *strata* (a street) come Stratford, Stratton, Stradbrook.

From *fossa* (a ditch) come Fossbury, Fossdyke, Fossway.

Geography.

Answer either Q. 2 or Q. 3.

1. Draw a full map of Egypt, Arabia, and the Isthmus of Suez. Insert the lines of latitude and longitude.

2. Give notes of a lesson on 'A Voyage from Buenos Ayres to Lima.'

N.B.—*Do not waste time on introduction.*

Map of Voyage to be sketched on blackboard as the lesson proceeds.

Buenos Ayres, on southern shore of the Rio de la Plata, has great trade; the principal exports being beef, hides, skins, tallow, and wool, obtained from the cattle which swarm on the pampas.—*Monte Video*, on northern shore of the same estuary, has large trade.—*Estuary of La Plata*, about 180 miles long, and 130 miles broad at its mouth.—Leaving the La Plata, our

course is south, along the coast of *Patagonia*.—Passing the *Falkland Islands* on our left, we reach the *Strait of Magellan*, which is 300 miles long, and from one to forty miles broad. Its shores are rugged and extremely dangerous, owing to currents. —Here is a group of islands called *Tierra del Fuego*, or 'Land of Fire;' so named from their volcanic origin.—The inhabitants are sunk in the deepest barbarism.—Proceeding up the west coast of Patagonia, we pass a chain of islands, the largest of which is *Wellington Island*.—*Chiloe* is a fertile island, with abundance of cattle.—On the coast of Chili we pass *Conception*, and further north *Valparaiso*, a flourishing town, the centre of a great trade in tallow, hides, etc., and *Coquimbo*, another port of Chili, with mineral exports, especially copper.—*Juan Fernandez*, opposite Valparaiso, was the island where Alexander Selkirk lived his solitary life, and thus was the original of 'Robinson Crusoe.'—Proceeding northwards the next important place is *Arica*, the outlet for the produce of Bolivia.—Close to this port lies the island of *Guano*, from which manure is obtained.—Our course now lies in a north-westerly direction till we arrive at *Callao*, the port of *Lima*, the capital of Peru, which lies six miles from the coast.—A short distance south of this are the *Chinca Islands*, noted for guano deposits.

3. Name six important towns in the United States, and describe the situation and character of each.

New York is situated on Manhattan Island, at the confluence of the Hudson and East River. The city is triangular in form, and traversed by regular and handsome streets, the largest of which is the famous Broadway. New York is the chief commercial emporium of the New World. Brooklyn, on the opposite shore of the Hudson, is regarded as a suburb of the city.

Philadelphia, at the confluence of the Delaware and Schuylkill, formerly the capital of the United States, is the second city in the Union in regard to population and importance.

St. Louis, a large and growing city on the right bank of the Mississippi, 1,200 miles above the mouth of the river, is the centre of the overland trade with Mexico, and an important military station.

Chicago, situated on Lake Michigan, in the heart of the great grain-producing States, is one of the largest grain markets in the world. It is also the great shipping *depôt* of an immense fertile region.

Cincinnati is admirably situated in regard to commercial facilities, and carries on an immense traffic by means of its river, canal, and railway communications.

New Orleans, on the left bank of the Mississippi, 105 miles from its mouth, is by far the most important in the vast river-basin in which it is situated, possesses unrivalled advantages for inland trade, and, next to New York, is the principal emporium of the Union.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How did William the Lion fall into the hands of Henry II., and upon what terms did he obtain release?

During the revolt of the English baronage in the reign of Henry II., William the Lion, to assist them, laid siege to Alnwick Castle. He was surprised by Glanville, one of Henry's generals, and captured. William was not released until he consented to hold his crown of Henry and his heirs. The prelates and lords of Scotland did homage to Henry as to their direct lord, and a right of appeal in all Scotch causes was allowed to the superior court of the English suzerain.

2. In 1798, how came English and French to be fighting in Egypt? Give some account of the battle of Alexandria.

Napoleon's ambition led him to form a grand scheme for the conquest of our possessions in India; and as Egypt was, and still is, the key to the gaining of that country, he landed a force at Alexandria. His fleet being destroyed by Nelson in Aboukir Bay, Napoleon left a portion of his forces in Egypt, and marched into Syria. The army left behind was attacked by Sir Ralph Abercrombie. In the face of a tremendous fire from two thousand five hundred French, entrenched on the sand-hills near the shore, as well as from a number of big guns, Sir Ralph landed his men; who, according to orders, did not fire a shot, but charged with the bayonet the enemy stationed on the heights, put them to flight, and seized their cannon. About a fortnight after the landing was effected was fought the decisive battle of Alexandria (1801), in which, after a sanguinary and protracted struggle, the British were victorious, the French General being forced to retreat with a loss of between three and four thousand men. The loss of the British was also heavy, and this was the last field of the victor, for Sir Ralph Abercromby received his death-wound.

3. When did the First Imperial Parliament of Great Britain and Ireland assemble, and how was it composed?

The First Imperial Parliament of Great Britain and Ireland assembled on the 1st of January, 1801. To the House of Commons England sent 486, Wales 27, Ireland 100, and Scotland 45 members. To the House of Lords Ireland sent 28 temporal and 4 spiritual; Scotland, 16 temporal; England, about 400 temporal and spiritual peers.

Penmanship.

Write in large hand, as a specimen of copy-setting, the word *Egyptian*.

Write in small hand, as a specimen of copy-setting, *Land Tenure and Agriculture in Russia*.

Composition.

Write a short essay on *Fables and their uses*. (Illustrate the subject by giving any fable you can remember.)

FABLES AND THEIR USES.

In a general sense fables mean fictitious narratives, but they also mean more particularly a species of composition, consisting of short fictitious tales, written for the purpose of teaching some moral truth or precept. The fable is sometimes divided into two kinds, the *fable proper* and *the parable*. The parable narrates some incident which, although it may not have happened exactly as the narrator supposes, yet could have happened, there being nothing impossible or improbable in it. The fable proper, on the other hand, relates facts which are evidently untrue, and could not have happened; such as animals, or even inanimate things speaking, but which serve as comparisons for the actions of men. The fable embodies a moral in a special case; this is invested with reality, and narrated as a story, which suggests the moral at once. Thus the well-known story of 'The Man and the Bundle of Sticks' embodies a moral truth, namely, the power of union.

Many of the fables proper, or Apologues as they are called, turn upon the actions and characteristics of animals. This practice has evidently risen out of the circumstance that the animals chosen have a certain fixed character; as the cunning of the fox, the strength of the lion, the meekness of the lamb.

When a fable is lengthened into details, so as to form long and sustained comparison, it is called an Allegory.

Euclid.

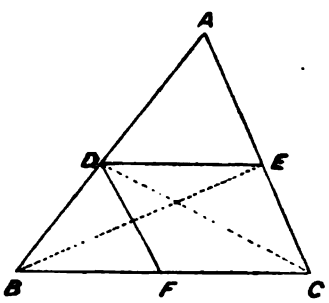
MALES.

Answer two Questions, including Q. 1 (if possible).

[All generally understood abbreviations for *words* may be used.]

1. The straight line which joins the middle points of two sides of a triangle is equal to half the base.

Let the sides AB, AC of the triangle ABC be bisected respectively in D and E; join DE; then DE shall be equal to half the base.



Join BE, DC.

Because AD=DB and the triangles ADE, BDE have the common vertex E (that is, are between the same parallels) then the triangle ADE=the triangle BDE.

For the same reason the triangle ADE=the triangle CDE and ∴ the triangle BDE=the triangle CED.

But the equal triangles BDE, CDE being upon the same base DE, must be between the same parallels. ∴ DE is parallel to BC.

In the same manner it may be shown that if BC be bisected in F, DF is parallel to AC.

Now since DE is parallel to FC and DF to EC, DFEC is a parallelogram, and DE=FC, that is, half the base.

Q. E. D.

2. If there be two straight lines, one of which is divided into any number of parts; the rectangle contained by the two straight lines, is equal to the rectangles contained by the undivided line and the several parts of the divided line.

Prop. 1, Bk. II.

3. If a straight line be divided into two equal parts, and also into two unequal parts; the rectangle contained by the unequal parts, together with the square on the line between the points of section, is equal to the square on half the line.

Prop. 5, Bk. II.

Algebra.

MALES.

1. *Prove* that the L.C.M. of two expressions is their product divided by their G.C.M.

Show that $2a+3b+c$ is the G.C.M. of $ab+2a^2-3b^2-4bc-ac-c^2$ and $9ac+2a^2-5ab+4c^2+8bc-12b^2$.

(*a*) Let A and B denote the two expressions and D their greatest common measure.

Suppose A=*a*D and B=*b*D.

Then from the nature of the greatest common measure *a* and *b* have no common factor, and therefore their least common multiple is *ab*.

Hence the expression of lowest dimensions which is divisible by *a*D and *b*D is *ab*D.

$$\text{And } ab\text{D} = \text{A}b = \text{B}a = \frac{\text{AB}}{\text{D}}$$

That is the L.C.M. of two expressions is their product divided by their G.C.M. Q. E. D.

(*b*) Since $ab+2a^2-3b^2-4bc-ac-c^2 \div 2a+3b+c = a-b-c$

and $9ac+2a^2-5ab+4c^2+8bc-12b^2 \div 2a+3b+c = a-4b+4c$.

There being no factor common to $a-b-c$, and $a-4b+4c$, then $2a+3b+c$ must be the G.C.M. Q. E. D.

2. Add $\frac{2}{x}$, $\frac{3}{1-2x}$, $\frac{3-2x}{4x^2-1}$.

The L.C.D. $=x(4x^2-1)$.

$$\frac{2(4x^2-1)+3(-2x-1)x+(3-2x)x}{x(4x^2-1)} = \frac{8x^2-2-6x^2-3x+3x-2x^2}{4x^3-x}$$

$$= \frac{-2}{4x^3-x}$$

$$= \frac{2}{x-4x^3}$$

3. Solve the equations:—

$$(1)\ \begin{cases} 45x+8y=350 \\ 21y-13x=132 \end{cases}$$

$$(2)\ \frac{x}{x+3}+\frac{x+3}{x}=2\cdot9$$

(1) $45x+8y=350$, or $945x+168y=7350$

$-13x+21y=132$, or $-104x+168y=1056$

by subtraction $1049x = 0294$

$x = 6$ Ans.

Hence $y = 10$ Ans.

$$(2)\ \frac{x}{x+3}+\frac{x+3}{x}=2\cdot9$$

clearing of fractions, $x^2+x^2+6x+9=2\cdot9x^2+8\cdot7x$

clearing off decimals, $10x+10x^2+60x+90=29x^2+87x$

collecting, $9x^2+27x=90$

dividing by 9 and transposing, $x^2+3x-10=0$

factorizing $(x+5)(x-2)=0$

$x+5=0$ or $x-2=0$

$x=-5$ or $x=2$ Ans.

Mensuration.

1. The area of a map, which is on the scale of an inch to a mile is 4 sq. ft. 4 sq. inches; required the number of acres represented.

4 sq. ft. 4 sq. in. = 580 sq. in.

580 sq. in. represent 580 sq. miles.

1 sq. mile = 640 ac. ∴ 580 sq. miles = 580 × 640

= 371,200 acres. Ans.

2. A road runs round a circular piece of ground; the outer circumference is 600 ft. and the inner 480 ft.; find the breadth of the road.

If the circumference = 3⅐ times the diameter,

then diameter of outer circle = 600 ft. ÷ $\frac{22}{7}$ = $\frac{4200}{22}$ ft.

and " inner " = 480 ft. ÷ $\frac{22}{7}$ = $\frac{3360}{22}$

∴ diff. of diameters = $\frac{840}{22}$

" radii = $\frac{420}{22}$

" " = 19$\frac{1}{11}$ ft. breadth of road.

Needlework.

FEMALES.

One hour allowed for this Exercise.

—o—

THE TRAINING OF TEACHERS FOR MIDDLE AND HIGHER SCHOOLS.

THE FINSBURY TRAINING COLLEGE FOR SCHOOLMASTERS.

THE opinion that some special preparation is needed for the training of those whose intention it is to become masters in middle and higher schools has been rapidly gaining ground among all who have to do with practical education. It is a general complaint among head-masters that a large portion of their own time is absorbed in training their assistants, and that their assistants, for the first year or more, are only half effective. All other leading countries have made provision for training teachers above the elementary grade. England alone has no superior normal school for men, either public or private, and only two for women.

It was from a knowledge of this deficiency that, on the 11th of last May, a private meeting was held at the Middle-Class Schools, Cowper Street, City Road, E.C., to consider a scheme for a training college for schoolmasters, to be conducted on the same system as that which has been carried out with such success at the Bishopsgate Training College for Women.

A provisional committee was formed; the approval and support of a considerable number of head-masters and heads of colleges was obtained, and a public meeting was held at the Westminster Palace Hotel, on June 28th, the Earl of Morley taking the chair.

At this meeting it was stated that the Rev. W. Rogers, and the Corporation of the Middle-Class Schools, Cowper Street, had offered their schools as a model and practising school, and that Dr. Wormell, the head-master, had promised to co-operate. It was further resolved that a Guarantee Fund of not less than £1000 be raised to meet the estimated expenses of the first three years, during which the college could not be expected to be self-supporting.

The committee have since then received promises of support sufficient to justify them in appointing a

principal, and announcing that the college would be shortly opened. H. Courthope Bowen, Esq., M.A., lately head-master of the Grocers' Company's schools, has been appointed principal—an excellent choice, by the way—and it is proposed to begin work in January.

The list of the council of management, we notice, contains the names of many of the most prominent educationists of the day, and includes those of the head-masters of Rugby, Uppingham, Clifton, Marlborough, Charterhouse, University College School, Walthamstow Forest School, Cranleigh County School, Winchester College, and the Cowper Street Middle-Class Schools.

Under the auspices and patronage of such an influential committee the college can hardly fail to prove a great success.

The course of study will be mainly *practical;* consisting of (*a*) Model and Criticism Lessons, and (*b*) actual work in school classes for a certain number of hours weekly, under the direction of the principal. Students will be specially prepared for the Examination of the Teachers' Training Syndicate of the University of Cambridge, or for the Teachers' Diploma of the University of London; and classes will be held to enable those who have not a degree to obtain such degree or certificate as is required by the two universities.

Some of the lectures given in the college are open to outside students, who are engaged in teaching. Permission to attend must be obtained from the Principal, The Schools, Cowper Street, City Road, London, E.C., by whom also information respecting the Entrance Examinations, Forms of Entry, will be supplied.

We may add that the cost of tuition at the college is £24 yearly, payable in £8 instalments, at the commencement of each of the three terms into which the college year is divided.

For fuller particulars concerning the Examination of the Teachers' Training Syndicate of the University of Cambridge, mentioned above, we must refer our readers to Mr. Oscar Browning, Secretary to the Syndicate, King's College, Cambridge. Information respecting the Teachers' Diploma of the University of London may be obtained on application to 'The Registrar of the University of London, Burlington Gardens, W.'

Publications Reviewed.

The Drama as an Element of Education. By Capt. Dumaresq de C. Bisson. London: Simpkin and Marshall.

This is an essay read at Westminster before a large assembly of eminent personages interested in educational questions and the higher development of the Drama, and is dedicated by its author to Mr. Henry Irving. It appears to have been published by request of the distinguished audience mainly with the view of bringing into prominent notice 'the Dumaresq Edition of Shakspere,' two of the plays, 'Julius Cæsar' and 'King Lear,' being already published with the notes of S. T. Coleridge, and 'authorized for use at colleges and schools and the Boards of Military Examination.' The essay is a fair *resumé* of, first, the influence of the Drama on national character, wherein the writer argues that Rome's decadence might have been more or less arrested if, instead of the brutalizing sports of the Coliseum, the more humanizing amusements of the theatre had been substituted; and that Spain would have never fallen so low if the people had been entertained with plays and farces rather than with bull-fights and *autos-da-fé*. The second portion gives in detail the origin and progress of English Drama, from Udal and Sackville up to Shakspere, whose life and writings are given in part three. We may note as a curiosity of literature that Herr Elze, an eminent Teutonic Shaksperian scholar, identifies Desdemona with a princess of the house of Hohenzollern,—her name in Greek signifying 'the unfortunate.' The remainder of the volume is taken up with Captain Bisson's introductory notices of several schools and colleges to which he stands sponsor; and some stanzas by his friend Roscoe Morgan on 'The Queen's Return from Mentone,' and 'The Persecution of the Jews in Russia.' It may, by the bye, be worth mention, that Mentoné is more properly, after the Italian, pronounced with the final e (as if rhyming with 'stoney'), and not as if the French Mentōne, rhyming it as Mr. Morgan does with 'thrown.'

'The Midland' Algebra. Part I., for Stage I. Code, 1882-3. London: John Marshall and Co. Birmingham and Leicester: Midland Educational Co.

As its title shows, this little text-book has been prepared to meet the requirements of the New Code Specific Subject in Algebra, Stage I., and a careful perusal shows that its aim has been carried out in a very efficient manner. The general principle adopted is, we are confident, the only one likely to be successful in school work. It is to seek to impress on the learner's mind every fresh fact that occurs in the shape of definition, sign, or rule, by means of numerous well-chosen examples and exercises. Almost *every* definition has its own exercise, and the examples given therein are copious and well chosen. The fact that no less than twenty-three exercises, besides numerous examples and miscellaneous questions, are given on the thirty-four sections of explanatory matter of which the book consists, will show how completely this method has been carried out. The simple way in which the *raison d'être* of the rules of signs in addition and subtraction is explained, deserves particular mention. In simple language, and by the use of appropriate examples, this difficulty, so often an obscure point to young algebraists, is so clearly expressed as to be readily understood by any child of ordinary intelligence.

The answers are embodied in a separate book.

'The Midland' Algebraic Test Cards. Stage I. London: J. Marshall and Co. Birmingham and Leicester; Midland Educational Co.

This set is based on the text-book referred to above, and to those who use it (and we feel sure they will be many) will prove most serviceable. The examples are carefully graduated, and deal most exhaustively with all points met with in that portion of Elementary Algebra covered by the text-book. We think that some of the sums are a trifle difficult, but no doubt these have been inserted purposely by the compiler from a knowledge that those who take in this specific subject will not be dullards. The cards are clearly printed on stout cards and enclosed in a serviceable cloth-covered case.

New Light through Old Windows. By Gregson Gow. London: Blackie and Son.

This series of eight tales, designed to illustrate some fables of Æsop, are rather grave than gay, and more useful as cautionary examples for young men than pleasing to children. We have no right, however, to judge all juvenile books by the standard of juvenile amusement, and acknowledge the value of the lessons conveyed by Mr. Gow's stories. That of 'The Mother's Choice' will perhaps induce reckless youths to pause in the career of folly in which the mania for betting now largely enters. 'The Jay in Borrowed Plumes' is a story of school-boys' plagiarism, in which the honest lad is wrongly blamed

and the copyist at first commended. Of course truth comes out at last, and honest industry meets with its reward, while the artful trickster has to sneak off. Every other tale 'points a moral' indicated by the prefixed fable.

The Ball of Fortune. By Charles Pearce. London: Blackie and Son.

Messrs. Blackie take time by the forelock in dating this book 1883. This will not, however, prevent the reader being interested in this little novel, which is very readable, full of incident, smart in dialogue, and with a dramatic though perfectly natural ending. It would be unfair to describe fully what the ball of fortune is, other than that it is a real ball, and which is dexterously kept out of the hands of clever but unprincipled rogues. Their schemes and the straightforward honesty of the hero are cleverly portrayed. The printing, binding, and illustrations all deserve praise.

The Adventures of Mrs. Wishing-to-Be; and other Stories. By Alice Corkran. London: Blackie and Son.

The Christmas holidays will be not unprofitably spent by children if they have such capital books as this to read. Artfully throwing school aside under the fancy of laughing at the multiplication table and similar inflictions in the way of LEARNING, little ones are amused and beguiled into associating knowledge with pleasure. Their childish fairy-love is appealed to by introducing Cinderella, Red Riding Hood, and the rest of the goodly company into the narrative of adventures. Little Dodo is taken by Robinson Crusoe to his island, and there visits the house of the Three Bears, who threaten to eat her—all make-believe, you know—and then Robinson Crusoe comes to rescue her; and then she makes friends with the Bears; and then Mother Goose comes with a letter for everybody, and then, and then, and so on, to the end of the rapidly-changing kaleidoscope that will delight youthful readers.

Our Dolly. By Mrs. C. A. Read. London: Blackie and Son.

Our Dolly is not a wax or wooden figure—far from it. She is a little girl, and a nice little girl too, who now and then makes mistakes as all girls and boys do, but who tries to do her best. She sees many things that every boy and girl may see, and of which we are told just enough to interest us but not to tire us. Mrs. Read knoweth well the ways of childhood. The printing is good, the illustrations excellent, and the binding pretty.

Fairy Fancy. By Mrs. C. A. Read. London: Blackie and Son.

Under the guise of a little fairy, with whose autobiography the reader at once becomes identified, we are led through pleasant tales of animals and their amusing adventures, in which a knowing raven, Toph, generally outwits a clever dog and an equally artful pussy. From animals we are led to pleasing personages, among whom is an attractive youth named Ernest, who becomes a famous violinist and composer. All is pleasant, nice reading, with a little knowledge of natural history and other dry matters gently introduced and thus divested of dryness. The book is well printed, well bound, and well illustrated. The frontispiece is a pretty coloured, or rather delicately tinted, picture of a little girl, and the usual rather ugly but yet benevolently-disposed old woman, whose acquaintance we advise the reader to make.

Nat the Naturalist. By Geo. Manville Fenn. London: Blackie and Son.

Scott gave us a great deal of history in fiction, and also with it some considerable fiction in history. Geography and the most salient features of natural history are by no means unimpressively taught by stories of travel and adventure. Of this the book before us is an agreeable specimen. The early taste of a schoolboy in this direction is shown by his preferring to spend his half-holidays on Clapham Common hunting for efts and lizards, and to catch the bright sticklebacks in the ponds. Thus beginning, Mr. Fenn carries his protégé on through the pleasant fields of foreign adventure, in which natural history forms the most prominent feature. Touches of humour are introduced in the character of a black companion. We are taken to the Eastern Archipelago, among bright-coloured birds, big snakes, and lots of adventure.

Brother and Sister. By Elizabeth J. Lysaght. London: Blackie and Son.

This novel for youthful readers tells us of the 'uses of adversity' in a manner that will both interest and edify. Tom, the hero, is left with his family in straitened circumstances by the failure of his father in business. He is taken in hand by a merchant; tempted by an artful fellow-clerk; maintains his simple integrity; and makes his way step by step in the path of successful effort. Such a course has been often told, but is nevertheless an ever-welcome tale, especially when detailed so interestingly as this is by Mrs. Lysaght. The book is in all respects well got up.

Facing Death. By G. A. Henty. London and Glasgow: Blackie and Son.

A spiritedly-written tale of the coal-mines, whereof one, Jack Simpson, is the hero throughout, in the midst of such antagonistic elements as strikes, explosions, dog-fights, man-fights, riots, mine incarcerations, hard times, and other usual incidents of Stokebridge and its brutalized inhabitants. Of course, Jack is the perfect contrast throughout to all his bad surroundings; and as the good boy, the strong man, the night-school scholar, the local civilizer, and ultimately the new manager, and the happy bridegroom, fulfils every phase of this melodrama of low life in its coarsest form, by being justly rewarded in the compensation of final success accorded to pluck, principle, and perseverance. Just the book for boys.

Under Drake's Flag. By G. A. Henty. London and Glasgow: Blackie and Son.

This is another of the beautifully got up 'New Series for the Young,' issued by Messrs. Blackie, and by the same author as in our last notice. Being a graphic piece of English history, it *practically teaches* what life was like in our land and on our seas in 1572 and thereafter, and is full of military and maritime exploit sufficient to charm 'a whole wilderness of' school-boys, to whom Sir Francis Drake and his patriotic adventures have been a source of rejoicing and a fountain of courageous inspiration now for several generations. The volume is in this respect perfectly recommendable, and if somewhat too sensational in parts for the ordinary prose of common life, is perhaps thereby all the better fitted for the juvenile readers who will delight in its ornate pages.

In the King's Name. By G. Manville Fenn. London and Glasgow: Blackie and Son.

Of the least of pretty books lately sent to us for notice by the enterprising house of Blackie, this is perhaps the best in a literary point of view, the author having long achieved success as a writer who knows how to combine humour with incident. This 'Cruise of the Kestrel,' the second title of the book, is a record of smugglers and excisemen in Jacobite times, touching incidentally upon the exciting times of Charles Edward after Culloden, wherein 'the brave sailor, Captain Hilary Leigh, does many gallant acts for his country's good and in the King's Name.' All Messrs. Blackie's publications in this series are beautifully illustrated and appropriately bound with great taste and cost in decoration. They are just the books for prizes at school, or presents to the boys at Christmas.

Elements of Morality, in Easy Lessons, for Home and School Teaching. By Mrs. Charles Bray. London: Longmans.

This little book, paragraphed in orderly fashion, and each chapter epilogued with questions to rivet every sentence on the infant mind, may have its good uses in the younger classes of school or nursery, especially as it is interspersed with anecdotes and illustrations. But for deeper thinkers and higher scholars Moralities are the fruits which spring entirely from the taproot of Religion, and it is not until we come to the last few pages that we are referred to our 'Union with the Unseen.' The surest growth of good morals will follow on a dressing of the root with all heart-diligence; works being dependent upon faith, and a true life here growing from the direct hope of the Better Life hereafter. The building up of Morality as a house on the sand is a mere Aristotelian process: Paul and John lay the foundations more truly and more surely in faith, hope, and charity. However, while we say this, we have no desire to disparage the very pleasant and suggestive booklet thus recently produced by a well-known authoress.

Health Lectures for the People. 5th Series. London and Manchester: John Heywood.

These lectures are issued by the Committee of the Manchester and Salford Sanitary Association. This Association has taken advantage of the collection of large bodies of work-people after their mid-day meal, and arranged to give them the lectures now collected in the book before us. The lectures are, without exception, well written, and in such a simple and yet scientific style, as to ensure a good reception, not only among those for whom they were originally intended, but among a much larger circle of readers.

Each lecture deals with one or more of the preventible class of diseases, and discusses the means of preventing it; the only exception to this rule being the lecture by Dr. Ashby on 'Infant Feeding in Relation to Infant Mortality. We are glad that an exception has been made in favour of this subject. It is dealt with very ably, and the causes and means of removing the excessive mortality among children are given in detail.

The inclusion of a lecture on Consumption in a course devoted to preventible diseases is especially appropriate, inasmuch as Koch's researches on Tubercle, the publication of which is of a later date than the lecture in question, go very far towards proving that consumption is due to definite microscopic organisms like other infectious complaints. Be this as it may, the practical lesson stated in this lecture, enforcing cleanliness and ventilation as preventatives, remains equally pertinent.

In the lecture on Scarlet Fever we are especially glad to see the following sentence:—'However slight the case may be, the same care must be taken in dealing with it, for it is found by bitter experience that the mildest form in one person may communicate the most fatal form of the disease to another; and also that most dreaded complication, dropsy, follows actually oftener on mild attacks than on severe ones.' This statement cannot be too strongly recommended to the careful notice of all parents and teachers.

The unfortunate mistake made by the general public, in supposing that scarlatina and scarlet fever are two different diseases, is exposed in the same lecture. We quite agree that 'the use of the word scarlatina, by giving to the attendants on a case a sense of false security, become a source of positive danger, and it would be well if the word dropped out of our language altogether.'

The lecture on diseases produced by Drink is perhaps the least satisfactory of the series. Drink is a most potent and fertile source of disease; but surely the number of actual diseases produced through its baneful influence is so great as to require no additions from a doubtful list. The description of 'gin-drinker's liver' is somewhat imperfect; and the numerous nervous diseases due to alcoholic excess are left for a future lecture.

Fevers in general form the subject of a very good lecture. The description of Pasteur's experiments on the Bacillus, to which Splenic Fever is due, stops short at the most interesting point. Just sufficient detail is given to whet one's appetite. We are told that Pasteur discovered the method by which thousands of cattle are yearly saved from disease and death; but we are left in the dark as to the process by which this is accomplished.

The next lecture appears under the title of Small-pox and Vaccination. We wish this lecture were published separately and distributed everywhere. It clearly states the facts of this vexed question; and without *over*-burdening the subject with figures, gives a masterly and most conclusive statement of the superlative value of vaccination.

'Colds and their Consequences' are dwelt on by Dr. Dreschfield in a very interesting and valuable lecture.

The series is completed by lectures on 'Measles and Whooping Cough,' 'Typhus and Typhoid;' the whole forming a most interesting and valuable course.

We cannot too strongly recommend the book. Teachers will find much matter of great importance in their relation to their pupils as well as in private life.

The book is well printed, is very free from printers' errors, and is bound in a gay cover, having a pictorial representation of the four great requisites for good health—cleanliness, good food, healthy homes, and pure air.

Winners in Life's Race; or, the Great Backboned Family. By Miss A. B. Buckley. Stanford, 55, Charing Cross.

This work is intended to supply a sequel to another charming book by the same authoress, entitled 'Life and her Children.'

It is written in an easy and most interesting style, and if we are not mistaken will form a very popular gift-book for intelligent boys and girls. It is an elegant book, very profusely illustrated, and will be welcomed not only by the young, but by all who enjoy a fresh and glowing account of the beauties of animal life.

In a pleasant way we are introduced to vertebrate animals in general, and the gradations in complexity of structure which they manifest are skilfully described.

As the title indicates, the history of vertebrate animals is worked out from the evolutionist standpoint; and the law of the survival of the fittest is accepted in its entirety.

This, however, does not in any sense render the book unfit for perusal by any youth, as the following extract to some extent shows:—'There was growing up among us that patient lover and searcher after truth, Charles Darwin, whose genius and earnest labours opened our eyes gradually to a conception so true, so deep, and so grand, that side by side with it the idea of making an animal from time to time, as a sculptor makes a model of clay, seems too weak and paltry ever to have been attributed to an Almighty power.'

A prominent feature of the book is the beautiful illustrations, all of which, with the exception of about twenty, are new, and have been expressly drawn for this work. The figures are uniformly good and life-like. In addition to the figures of living animals, we notice some very useful drawings of skeletons.

At the head of each chapter is a pictorial representation of the primeval animals of a given section of the vertebrate sub-kingdom. These geological restorations, given as picture headings, increase very greatly the value of the book; as does also the geological aspect from which the subject is treated in the body of the work.

Teachers will find here abundant material for Natural History lessons; and it is only fair to add that the book, while most popular in its treatment of the subject, is scientifically accurate and reliable.

Alice through the Looking-Glass, and other Fairy Plays for Children. By Kate Freiligarth-Kroeker. London: W. Swan Sonnenschein and Co.

We have here four nice little plays for children, which, if somewhat wanting in dramatic incident, make up this by genial humour. The dialogues are easy, never dull, and abound in the gentle drollery of repeating grotesque words easily learnt by children and capable of being effectively rendered. This field of amusement is not half sufficiently cultivated. The selection before us comprises also some pretty German melodies set to humorous words of the nursery type. The book will be a welcome aid to juvenile Christmas parties. The printing and binding are excellent.

True to Himself; or, the Story of Savonarola. By Frances E. Cooke. London: W. Swan Sonnenschein and Co.

The touching story of the great Italian martyr is here detailed in glowing terms. His yearning after usefulness and intense devotedness to his calling are well described. At last he made himself heard. Crowds flocked to hear him wherever he went. His power of the Italians increased and rendered him an object of dislike to the Pope. The story of his persecution and martyrdom is generally too well known to need detail from us, and may be learned from the able pages before us. The book is excellently printed on fine and delicately-toned paper. The binding is neat and good.

Tales of the Olden Times. By Ella Baker. London: W. Swan Sonnenschein and Co.

We have here a pleasing collection of tales free from everything sensational or exciting, and free also from inspiring children with a love of the warlike which marks many tales. Several of the tales are founded on history, others are traditional, but all are deserving of commendation. The printing, bearing the impress of 'The Modern Press,' is hardly satisfactory—more to bad ink than to defective type, though that is faulty. This—probably cheap—will also spoil the woodcuts. From the modern press we expect something better than the ordinary productions of the old. The pretty cover bears the title of 'Stories from Old History.'

The Life of John Wiclif. By William Chapman. London: W. Swan Sonnenschein and Co.

We have in a beautifully-printed little book on paper fit for a *de luxe* edition an interesting life of the great herald of the Reformation. This is prefixed by a general sketch of the rise of the pontifical power that culminated in the craven submission of John after the two years' interdict. The Barons took no notice of the Papal claims, to the great rage of the Pope, who issued a bull annulling the Charta. But the Barons were made of very different stuff to be frightened by Papal Bulls, and after this the kings of England ascended the throne without taking the oath of fealty. In the reign of Edward II. the yearly tribute of 1,000 marks was discontinued, and the Pope was so shorn of his power as to think it wise not to make any remonstrances! Now and then arose good men and true among the priests who opposed the most glaring of Papal abuses. Among these were Greathead (Robert Grossetête), Bishop of Lincoln; Henry of Bracton, the great lawyer; William of Oscam, the Franciscan; Richard Fitzralph, Primate of Ireland; and the 'Profound Doctor' Thomas Bradwardine, who contributed largely by his personal influence to the successes of Edward III. in France. But all these pale before the star of John Wiclif, whose patriotism and love of the poor was as remarkable as his religious zeal. To this spirited sketch we refer the reader, regretting that our limits preclude quotations from the well-written pages.

Hiawatha and other Legends of the Wigwams. Compiled by Cornelius Matthews. London: W. Swan Sonnenschein and Co.

The name of Hiawatha may induce some to expect a reprint or summary of Longfellow's beautiful poem. But on taking up this book they will see instead a collection of delightful tales founded on the legendary lore of the North American Indians. The poetry of the folk-lore of all nations is perhaps more seen in the fairy tales that exist in all languages, and which doubtless formed the principal solace of rest from labour in the infancy of nations. Gladly we turn to it also as a grateful relief from our history, geography, and other most useful but alas! most dry studies. More gladly will our rather overworked youthful readers here revel in the rich yet by no means uninstructive fields of North American poetical legend. We notice with pleasure a goodly list of the same publishers, entitled 'The Fairy Tales of All Nations.' We hope, and from the book before us may expect, some at least of these may justify the remark of Dr. Johnson in speaking of the 'Arabian Nights,' 'Robinson Crusoe,' and 'The Pilgrim's Progress,' as the three books that every one wishes were without an end. Of course we must grind away about London being on the Thames, and Paris being the capital of France, and all that, but now that Christmas is coming, let our youthful readers enjoy the sweet plums they will find in this capital pudding.

The Heroes of African Discovery and Adventure. By C. E. Boume. London: W. Swan Sonnenschein and Co.

Among the books of African exploration, few that we have met with are more readable, and in other respects commendable than the one before us. It treats of the course of African discovery from the death of Livingstone to the present year. With a goodly number of very good full-page woodcuts, several capital maps printed in colours, and a few extra illustrations also printed in colours, nothing is wanted to render the book attractive as well as readable. We ought to add that well-drawn portraits of the 'Heroes of African Discovery' adorn the chapters devoted to each.

Tales from the Edda. By Helen Zimmern. London: W. Swan Sonnenschein and Co.

Norse literature has received considerable attention of late, but is yet capable of yielding much pleasing fruit, especially of the legendary kind. The exuberant fancy which bears remarkable impress of the wild features of northern scenery is shown in the legends of Odin, Thor—the ruler of the clouds, storms, and hurler of the thunderbolt—the sinless and beneficent Baldur, the crafty trickster, Loki, together with the beautiful Freyja (Friga), and other goddesses, are often quoted to show the affinities between Norse and Greek Pantheism. The merry times of the Norse heroes in Asgard are told in Edda, from which collection the present pleasing little book is made up. The illustrations, mostly by Kate Greenaway, show that this lady is equally at home with the severe and classical as with the quaint and charming grandmotherly little girls with whom she is so pleasingly associated. Both printing and binding are commendable.

Handwork and Headwork. By the Baroness Bülow. Swan Sonnenschein and Co.

This is a translation by Mrs. Christie from the German of one of the well-known Kinder-Garten manuals, written in the keynote of Froebel's educational theory, which we gather to be that we must not overload young children's brains with hard knowledge, but teach them by amusements and illustrations suitable to their infantile capacity the truths that may make their lives happier and more useful hereafter. It is, in fact, much what Charles Kingsley taught in that humorous episode about the turnip-headed children in 'Water Babies,' showing what a muddled mass their brains had become through over-education of the mind before proper development of the body. Early precocity is often fatal, always harmful.

Homer's Stories Simply Told. By C. H. Hanson. With ninety-seven illustrations by Flaxman and others. Nelson and Son.

The pictures alone are more than sufficient recommendation for this beautiful volume, which the classic pencils of Flaxman, Blake, and Retsch (at least so we guess at the anonymous 'others') have combined to illustrate thus copiously. With respect to the literary part, Mr. Hanson has herein and with similar success followed the time-honoured lead of Charles Lamb, in his well-known 'Tales from Shakespeare.' However, as metrical expression is in itself a special charm, we cannot for our own parts see that prose is any improvement upon poetry; and if we were required to read—whether aloud or quietly—the famous stories wherewith the Iliad and the Odyssey are so full, we should prefer (if not equal to the Greek originals) such metred versions as those of Derby, Cooper, or Chapman, or even the less accurate but still very vigorous rendering of our old friend Alexander Pope. But, after all, brevity is a need-be in this life, and if picturesque poetical descriptions are summed up shortly in simple prose, something is no doubt gained for patience and clearness; and so Mr. Hanson's labour in an educational sense is thus far practically of value.

Lost in the Backwoods. By Mrs. Traill. Nelson and Sons.

A story of three children, who, in the Canadian wilds of fifty years ago, get lost in the woods, and quite impossibly live the lives of juvenile Robinson Crusoes, encountering all sorts of risks and hardships apparently 'without turning a hair,' and falling in with divers now extinct tribes of Chippewas, Mohawks, and the like, who appear mainly in the very amiable but unlikely character of benefactors. It is a tale of woodcraft and wilderness adventure to interest children, but, considered as a contribution to educational literature, our *Practical Teaching* would send readers elsewhere for reliable information as to Canada or the Red Men, or the feasibility of an Eden-like livelihood where all must be hardship and peril and ultimate starvation. The volume is prettily illustrated and tastily bound.

Recent Expeditions to Eastern Polar Seas under the Austrian Government. With twelve engravings and two charts. London: Nelson and Sons.

We have here in a popular and decorative form for the English reader the result of several years' hardship and adventure in the Arctic Circle—a most easy and luxurious way of encountering and overcoming the perils and costs of extreme travel; and the enterprising firm of Messrs. Nelson and Sons have thus made pleasantly accessible to those who in these rapid times both 'read and run,' all that may be learnt from the voyages of the *Hansa*, the *Germania*, and the *Tegethoff*. Of course, to get the full benefit of this, the lively little volume must be steadily read: but on the most cursory view the eye is caught by the spirit and beauty of the illustrations, while the interest of readers is enthralled on every page by the courageous hardihood of our race in combating hopelessly the indomitable rigours of a well-nigh everlasting winter. However, geographical knowledge has been advanced by some few leagues forcibly conquered. Northwardly and eastwardly, and in the short Polar summer, the *Tegethoff* found an open sea in latitude 77° 40′ N., longitude 61° E.

In the Temperate Regions; or, Nature and Natural History in the Temperate Zones. Nelson and Sons, Paternoster Row.

This is a prettily-bound and well-illustrated volume, full of animal anecdote and human adventure and travel; sure to be a favourite with prizewinners at schools, and in fact with girls and boys and more grown-up children everywhere. It is thoroughly recommendable as a gift-book. For the amusement of our readers we add one or two of its stories. Here is one of a 'grizzly':—

'A party of voyagers, who had been employed all day in working a canoe up the rapids of the Saskatchewan, had seated themselves in the twilight by a fire, and were busily preparing their supper, when a large grizzly bear sprang over their canoe, which they had tilted behind them as a protection against the wind, and seizing one of the party by the shoulder, carried him off. The rest fled in terror, with the exception of a half-blood named Bourasse, who grasped his gun and pursued the bear as it retreated leisurely with its prey. He called to his unfortunate comrade that he was afraid of hitting him if he fired at the bear: but the man besought him to fire immediately, as he was being squeezed to death. Whereupon Bourasse took a steady aim and discharged his rifle into the body of the bear, which instantly dropped its prey to follow this new antagonist. The latter, however, escaped, though with some difficulty, and the bear retreated into the dense coppice, where it is supposed to have died.' Here is another about an eagle, to parallel the Harpy of Odysseus:—

'The birds of prey in Central Asia have so little fear of men that they boldly enter the encampments of travellers and carry off provisions. An incident of this nature is described by the Abbé Hue, who on one occasion had seated himself, along with his companions, to sup on a quarter of a kid prepared by the skilful hands of a Tartar cook. "We had just planted ourselves," he says, "in a triangle on the grassy sward, having in our midst the lid of the pot, which served instead of a dish, when suddenly we heard a noise like thunder over our heads. A great eagle darted down upon our supper, and rose again with arrowy rapidity, carrying off in his claws some slices of kid. When we had recovered from our surprise we could do nothing but laugh at the adventure. However, our Tartar follower could not laugh, not he, but was exceedingly angry, not so much on account of the stolen kid, as because the eagle, in flying off, had insolently struck him with the tip of his wing."'

Ralph's Year in Russia. A Story of Travel and Adventure. With nine engravings. London and Edinburgh: Nelson and Sons.

Mr. Richardson, who dedicates the book 'to my father and mother in love,' has here given us the experiences of a youth of fifteen who accompanied his family for a year to St. Peterburg for education, as he thereby 'will have an excellent opportunity of acquiring two foreign languages, French and Russian:' and besides ordinary adventures and social scenes, Ralph contrives in his eventful year not only to exhaust St. Petersburg, Moscow, and Nidji Novgorod, but also to visit Siberia, and be hunted by wolves, bears, and the like; in fact, it is a pity that Ralph was not invented to be older than from fifteen to sixteen all told, as well as that the insertion of some well-known descriptions forbids us to believe that these Russian adventures are the author's autobiography, which the affectionate dedication half leads one to expect. There is not much of a story to be told beyond the daily life of a family moving in the rich and luxurious circle of Russian good society, the manners and customs whereof are described with fairly graphic power. The illustrations are very good, especially the picture of that giant palace, the Kremlin.

First Readings: Christian Doctrine. London: Bemrose and Sons.

We do not remember ever to have seen so much sound doctrine couched in simple yet beautiful words (mostly from the best of books) as is printed in this neatly got up little volume of thirty-two pp. The work is worthy of the highest praise, and is admirably adapted for the home, Sunday-school, or religious instruction in day-schools.

Some charming illustrations from the pencil of Mr. Gunston enhance the value of the book.

The Parallel New Testament. Oxford University Press.

It is almost too late in the day for us to add our well-deserved word of censure to the general condemnation of the New Revision. The time-honoured volume it was meant to supersede is happily more popular than ever. Dr. Conquest's 'Bible with 20,000 emendations,' now quite scarce, is hardly a greater failure; in the doctor's case (and the zealous venture ruined him) the cause was patent: he confessed in his preface total ignorance of the original languages, and so ignorantly and easily guessed at his corrections. In the revisors' case the causes of reaction in public opinion are quite as evident, being chiefly these: viz., first, that whereas the Authorized Greek text was to be translated, they commenced operations by setting up a new one, derived mainly from some recent MSS.; secondly, that whereas they promised to make as few changes as possible—and in fact those only of a necessary character—they have gone out of their way to alter without improving no fewer than 36,000 verbal renderings! thereby quite superseding that most useful book, Cruden's Concordance [they have been forced to make a new one], destroying and perverting innumerable passages in our literature, both prose and poetry, where the dear old book has been for ages accurately quoted, and shaking the faith of millions amongst our agnostic readers, not only as to verbal inspiration, but as to inspiration at all. Thirdly, after eleven years of monthly visits to London, with all expenses paid, the self-elected council of thirty have sent out all over the world a version not only of unreasonable and unmitigated change, but one wherein, if some small errors are corrected, very much greater ones have been perpetrated. Out of instances innumerable take these three: the sublime angelic message, 'Peace on earth, goodwill towards men,' is actually rendered 'Peace on earth towards men of goodwill:' the apocalyptic 'vials' are turned vulgarly into 'bowls;' and even the Lord's prayer has been tampered with, changing 'evil' generally into 'the evil one' particularly. But we have neither space nor patience for more: our animadversions might extend to a volume; and, indeed, there is quite a library extant on the subject, from Dean Burgon to Washington Moon. This Parallel Edition only serves to show more clearly the great superiority of our Authorized Version over that of those unauthorized revisors.

Macmillan's Progressive French Course. First Year. By G. Eugène-Fasnacht. London: Macmillan and Co.

This little primer contains a very fair first year's course, and we can confidently say that the child who has carefully and thoroughly worked through the fifty lessons of which it consists, will have no inconsiderable stock of knowledge on which to build up his after studies of the language. The lessons are very carefully graduated, and the words used in them and the vocabularies have been evidently chosen from their frequent occurrence in daily reading and conversation. This is a point too often lost sight of by many writers of French grammars and exercises, where works abound with words of the most out-of-the-way description. There is one little thing in M. Fasnacht's book which does seem a little odd. It is that the use of the contracted forms of the article (du, au, etc.) is not dealt with until the learner has advanced about one-third through the book (pp. 28, 29). From the frequency of the occurrence of these forms in conversation and literature we should have thought the learner's acquaintance with them could hardly have been made too early.

First Latin Grammar. By M. C. Macmillan, M.A. London: Macmillan and Co.

There is, of necessity, not much that can be *novel* in a Latin grammar, but what there is, in the way of arrangement or mode of treatment, peculiar to Mr. Macmillan's little book, is both well considered and well carried out. The quantities of the syllables have been carefully marked throughout, and thus much assistance is given to both teacher and learner. We say assistance to the teacher advisedly, for we all know how difficult it is to correct a false pronunciation when once thoroughly ingrained. We are glad to see that the author thinks as we do, that in a book intended for young learners the sandwiching-in of notes and addenda in small print amongst the other matter is to be avoided as much as possible, since it tends to distract and confuse the mind. In this book the notes are placed at the bottom of each page and may be omitted until the large print has been thoroughly learnt. Those facts and rules which could not be conveniently dealt with in short footnotes are relegated to the end, in the shape of five appendices, dealing respectively with the Latin Declension of Greek Nouns, Numerals, Roman Mode of Reckoning Time, Roman Money, and the Quantity of Syllables. The addition of a sixth appendix, dealing with the Old and New Methods of Pronunciation, would, we think, make the book more complete, and would prove a boon to many students.

Elementary Classics. (1) Virgil: Æneid I. Edited; with Notes and Vocabulary, by A. S. Walpole, M.A. London: Macmillan and Co.

This is a capital little book, thoroughly fitted by its neat and serviceable binding and its clear printing for school use. It contains all that is needed for a study of this first book of Virgil's Æneid—a life of the poet, the text of the poem, notes, and a vocabulary. The schoolboy has now no need to study from a *large* book containing all Virgil's works, by the aid of two or three *larger* dictionaries, but finds Lemprière, Liddell, and Scott, and Virgil, all within one cover. The text, being based on that of the best commentators, is as nearly faultless as can well be. We notice that many poetical quotations, illustrative of the text, from the versions of Conington, Morris, and others, and from the Odyssey, are given in the notes, with the intention (as expressed in the preface) of enabling 'a boy to realise for himself the way in which the artist uses his materials.' This is a feature which has much to recommend it.

(2) Selections from Ovid. Edited by E. S. Shuckburgh, M.A.

The general features of this booklet are similar to the preceding, and what we said in favour of that one we have pleasure in repeating with reference to this. The contents consist of selections, edited for school use, from (1) the *Fasti*, entitled, 'Early Roman Legends'; (2) from the *Epistles*, under the heading 'The Heroines'; and (3) from the *Tristia*, dealing with 'Ovid's Personal History,' together with a 'Life of the Poet,' and carefully compiled Notes. This book, unlike the former, contains no vocabulary.

(3) Livy. Hannibalian War (Parts of the Twenty-first and Twenty-second Books). By G. C. Macaulay, M.A.

One of the same series as the preceding, and equally fitted for school use. It is well, however, that the reader should bear in mind that this book is not a selection of extracts nor an edition of any part of the actual text of Livy, but that, in order to obtain a satisfactory Latin reading-book for the lower forms, the text of Livy has here 'been largely re-written and simplified,' and occasiona explanatory details have been added from Polybius. Mr. Macaulay appears to have effected his alterations and additions with great judgment and skill, and the result of his labours is the production of a very satisfactory and interesting book for junior class work. The two maps are excellent features, and are much clearer and better drawn than those in most books of a similar class. Altogether we can thoroughly recommend the book.

(4) Cæsar. De Bello Gallico. Lib. I. Edited, with Notes and Vocabulary, by A. S. Walpole, M.A.

Mr. Walpole, who, we gather from his preface, is himself a practical teacher, has in this little text-book given us as a result of his experience one of the most satisfactory and thorough introductions to the study of Cæsar's commentaries that we have met with. From beginning to end it is adapted to school use. The notes are judicious and concise, and the vocabulary at the end is supplementary to them, and contains explanations of all the more difficult idiomatic passages occurring in the text. The introductory sketch of Roman history in the time of Cæsar is, from its comprehensiveness and lucidity, not the least praiseworthy feature of the book.

Literature Primers. English Grammar. By the Rev. Richard Morris, M.A., LL.D. New Edition. London: Macmillan and Co.

Mr. Morris's reputation as a philologist and grammarian is a sufficient guarantee for the excellence of this little manual. It would be a difficult matter to give in an equally lucid manner, and within the same number of pages, more information on the subject than is here afforded us. If we may venture to suggest any improvement to be adopted in a later edition, it would be the addition of a Scheme for Parsing, giving a detailed method of dealing with each part of speech. This, we feel sure, would be a boon to many teachers and students, and its insertion in a book having so large a circulation as the one of which we are now speaking, would aid materially in introducing uniformity in style and arrangement wherever grammar is taught.

Cassell's Book of Sports and Pastimes. Part 8. London: Cassell, Petter, Galpin, and Co.

A good number of a good serial. This part deals in plain, simple language with Light, Heat, and Electricity, and describes many an experiment and instrument which the amateur of ordinary intelligence and skill could fashion for himself. The illustrations are clear and to the purpose.

Cambridge Texts with Notes. By Wilhelm Wagner, Ph.D. (1) The Adelphoe of Terence. (2) The Andria of Terence. (3) The Phormio of Terence. (4) The Hauton Timorumenos of Terence. Cambridge: Deighton, Bell, and Co.

Under the erudite editorship of Dr. Wagner it is little wonder that the above four small text-books are everything that is scholarly and thorough. The notes, placed at the end of each, are masterly in their way, and, while perfectly explanatory of the text and of the dramatic action of the piece, are not too voluminous and discursive on the *minutiæ* of scholarship. To the student of Latin versification the tables (given before the notes in each book) of the metres used in the play will be very welcome.

The Universal Instructor; or, Self-Culture for All. London: Ward, Lock, and Co.

It is a pity a little more attention had not been given to the illustrations in this number. Several (especially that on p. 761) show signs of having been rather unmercifully clipped to suit the size of the page, and the title-piece to Chap. VII. is upside down.

The subject-matter, however, is well up to the mark, and the chapters on Modern History, by Dr. Dulcken, and those on Electricity, Light, and Sound, from the pen, we believe, of the late Thomas Dunman, are especially readable and instructive.

Battle and Victory; or, the Story of a Painter's Life. By Mrs. C. E. Bowen. Griffith and Farran.

The opposition so generally experienced by a genius of any kind from his inappreciative home circle, has become proverbial: and Salvator Rosa is an example in point. His father, though himself an artist and architect, succeeded so little in his vocation, that he was resolved not 'to allow his son to take to the beggarly profession of painting,' but to force him into the priesthood for a living. Accordingly the boy runs away from home, and takes refuge with a brigand chief of the Abruzzo, who only spares his life as a probable spy by ocular demonstration on the spot that he is an actual painter; and so the great artist of brigand life gradually 'fought his way to fame, as from boyhood he had always declared he could and would do. He had conquered all difficulties, outlived envy, and could boast of having the hightest persons in the land desirous of being included in his acquaintance.' Such was the Battle and the Victory which Mrs. Bowen records: and as we perceive on the title-page that she is also authoress of 'Brigand Tales,' doubtless it fell into the best hands for graphic and accurate construction.

Wee Babies. By I. Waugh and A. Blanchard. London: Griffith and Farran.

The Messrs. Griffith and Farran are evidently determined to keep up the prestige of the old house of Newbury and Harris, so famous for the production of wholesome nursery literature. Miss Waugh, whose bright 'Holly Berries' of last season our readers may remember, is responsible for the wee babies as they appear in the flesh, and Miss Blanchard as they are clad in words. Children cannot fail to be charmed with this delightful volume. We should like to see the youngster whose eyes would not sparkle with joy when the book was opened at —say page 19, Dinah's baby. We give this handsome volume our best word; and our readers who want an extra nice book for a present—a piece of advice—buy 'Wee Babies.' You will thank us.

Our Little Ones. Vol. for 1882. London: Griffith and Farran.

Our readers will, in name at least, be pretty familiar with this journal, which now appears in volume form. We endorse all the good things we have said of the parts. Original in matter, and illustrations printed as only the Americans know how, and bound in a style worthy of the old established house whose imprint it bears, 'Our Little Ones' is a treasure house of good things for the young. We hope our readers will not overlook this volume when selecting their prizes.

New Code. By Richard Gowing. London: Grant and Co.

In this pamphlet we have not only the text of the now famous Mundella Code, but explanatory notes from official documents, calculations of annual grants, an introduction to the Code, and index. Mr. Gowing, the able and painstaking editor of the *School Board Chronicle*, is responsible for the work, which, it is a pleasure to say, has been done remarkably well. To school board members, managers, and teachers, this manual is almost indispensable. It has our hearty praise.

Fly-Away Fairies and Baby Blossoms. By L. Clarkson. London: Griffith and Farran.

If 'a thing of beauty is a joy for ever' there need be no sadness in young hearts where this superbly got-up volume finds its way. We regard it as a masterpiece of colour printing and cover decoration. The poetry also is far above the average. The volume is fit to grace any drawing-room.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. BOADICEA.—A can do $\frac{2}{7}$ of a piece of work in 13 days; at the end of that time B helps him, and they finish the work together in 6 days. How long would each be doing it separately?

A can do $\frac{2}{7}$ of the work in 13 days,
" " $\frac{1}{7}$ " " $\frac{13}{2}$ "
∴ A can do the work in $(\frac{13}{2} \times 7)$ days.
$= 45\frac{1}{2}$ days. Ans.

A and B can do in 6 days $(1 - \frac{2}{7})$ or $\frac{5}{7}$ of the work,
" " " 1 day $\frac{5}{42}$ of the work,
And A " " " $\frac{1}{45\frac{1}{2}}$ or $\frac{2}{91}$ " "
∴ B " " " $(\frac{5}{42} - \frac{2}{91})$ " "
$= \frac{65 - 12}{546}$ " "
$= \frac{53}{546}$ " " ;
∴ B can do the work in $\frac{546}{53}$ days
$= 10\frac{16}{53}$ days. Ans.

2. DESIDERATUM.—One pipe will fill a cistern in 8 minutes, and another will empty it in 15 minutes. If both be opened together when the cistern is empty, in how many minutes will it be filled?

Part filled by first pipe in 1 minute $= \frac{1}{8}$,
Part emptied by second " " " $= \frac{1}{15}$,
∴ Part filled, when both are open, in 1 minute $= \frac{1}{8} - \frac{1}{15}$
$= \frac{15 - 8}{120}$
$= \frac{7}{120}$;
∴ The cistern will be filled in $\frac{120}{7}$ minutes
$= 17\frac{1}{7}$ minutes. Ans.

3. LOUIE.—Simplify:—

$$(\tfrac{1}{2\frac{1}{6}} \text{ of } 3\tfrac{1}{2}) + (\tfrac{2}{3} \div \tfrac{21}{44}) - \left(\frac{1}{1\frac{1}{7}} - \frac{1\frac{1}{2}}{3}\right) \div (2 - \tfrac{5}{8}).$$

$$(\tfrac{1}{2\frac{1}{6}} \text{ of } 3\tfrac{1}{2}) + (\tfrac{2}{3} \div \tfrac{21}{44}) - \left(\frac{1}{1\frac{1}{7}} - \frac{1\frac{1}{2}}{3}\right) \div (2 - \tfrac{5}{8})$$

$$= \left(\frac{1}{\frac{13}{4}} \text{ of } \frac{\cancel{7}\cancel{3}}{4}\right) + \left(\frac{\cancel{2}}{\cancel{3}} \times \frac{\cancel{4}\cancel{4}}{\cancel{7}\cancel{7}}\right) - \left(\frac{\frac{1}{4}}{\frac{8}{7}} - \frac{\frac{3}{2}}{\frac{8}{1}}\right) \div 1\tfrac{5}{8}$$

$$= \tfrac{1}{8} + \tfrac{8}{9} - (\tfrac{7}{8} - \tfrac{3}{8}) \div 1\tfrac{5}{8}$$

$$= \frac{9 + 64}{72} - \frac{63 - 32}{72} \div 1\tfrac{5}{8}$$

$$= \frac{73 - 31}{72} \div 1\tfrac{5}{8}$$

$$= \frac{\cancel{42}}{\cancel{72}} \times \frac{\cancel{8}}{13}$$

$$= 2\tfrac{1}{13}. \text{ Ans.}$$

4. SWEET.—A man invested 9,000 guineas in the 3 per cents. at 81, and sold out when they had sunk to $67\frac{1}{2}$; what did he lose by the transaction?

£	£	£	
81	9,450	67½	
3	3,150	13½	Loss
		2	
		27	

$= £1575.$ Ans.

5. T. H. B.—If a person transfer his stock from the 3 per cents. at $73\frac{3}{8}$, to the $3\frac{1}{2}$ per cents. at $81\frac{1}{4}$, he would increase his income by £4 10s.; how much stock has he in the 3 per cents?

Income on £100 stock in the 3 per cents. $= £3$;
Income on this when transferred to the $3\frac{1}{2}$ per cents.

$$= \left(3\tfrac{1}{2} \times \frac{73\frac{3}{8}}{81\frac{1}{4}}\right) £$$

$$= \left(\frac{7}{2} \times \frac{\cancel{9}\cancel{5}\cancel{8}}{\cancel{6}\cancel{5}\cancel{0}}\right) £$$

$$= £\tfrac{63}{20}$$

$$= £3\tfrac{3}{20};$$

Gain in income $= £3\tfrac{3}{20} - £3$

$$= £\tfrac{3}{20};$$

∴ Quantity of stock in the 3 per cents.

$$= \left(100 \times \frac{4\frac{1}{2}}{\frac{3}{20}}\right) £$$

$$= \left(100 \times \frac{\frac{3}{\cancel{9}}}{\frac{\cancel{3}}{\cancel{20}}}\right) £$$

$= £3000.$ Ans.

6. MARINA.—The interest on a certain sum for two years is £71 16s. 7½d., and the discount on the same sum for the same time is £63 17s., simple interest being reckoned in both cases. Find the rate per cent. per annum, and the sum.—(*Hamblin Smith.*)

Interest − Discount = Interest on the Discount.
∴ £71 16s. 7½d. − £63 17s. = Interest on the Discount;

£7 19s. 7½d. = " " "
Interest on £63 17s. for 2 years = £7 19s. 7½d.,
" " " 1 year = £3 19s. 9¾d.;

£ s. £ £ s. d.
∴ 63 17 : 100 :: 3 19 9¾ : Rate per cent.
20 20 2000 £ s.
1277 2000 1277)7981 5 0(6 5
7662
319
20
6385
6385

£ s. £ s. d. £
∴ 12 10 : 71 16 7½ :: 100 : sum
Sum = £71 16s. 7½d. × 8
= £574 13s.

∴ Rate per cent. per annum = 6¼, and sum = £574 13s. Ans.

7. CIVIL SERVICE.—A man buys 100 animals for £100; of these, calves cost £5 each, lambs £1 each, and goats 5s. each. How many of each were there?

Difference between price of calves and average price = £5 − £1 = £4
" " " " " = £1 − 5s.
∴ No. of calves : No. of goats :: 15s. : £4
:: 15 : 80
:: 3 : 16

∴ No. of calves = 3, goats = 16, lambs = 81, or
calves = 9, goats = 48, lambs = 43, or
calves = 15, goats = 80, lambs = 5.

No. of calves = 6, goats = 32, lambs = 62, or
calves = 12, goats = 64, lambs = 24, or

8. COAL-PIT.—If the sun moves through 360° in 365·242264 days, what is its daily motion?

degrees
365·242264)360
60 min.
21600 000000(59
1826211320
3337886800
3287180376
50706424
60 sec.
3042385440(8·329
2921938112
120447328o
1095726792
1087464080
730484528
3569803520
3287180376
282623144

= 59 min. 8·329...sec. Ans.

9. SIGMA.—What number is that which, when divided by 24, leaves 23 remainder, when divided by 36 leaves 35 remainder, and when divided by 32 leaves 31 remainder?—(*Wormell's Arithmetic.*)

The number increased by unity is exactly divisible by 24, 36, and 32;

∴ Every common multiple of 24, 36, and 32 (decreased by unity), fulfils the conditions;
L.C.M. of 24, 36, and 32 = 288;
∴ No. = 287, or 576, or 863, etc.

10. EDINENSIS.—I have a certain sum of money wherewith to buy a certain number of nuts, and I find that if I buy at the rate of 40 a penny, I shall spend 5d. too much, if 50 a penny 10d. too little. How much have I to spend?

No. of nuts obtained for 5d. at former rate = 200
" " " 10d. at latter " = 500
700

Difference in rates = 10 a penny;
∴ Amount = 700/10 d.
= 5s. 10d. Ans.

11. FOLKESTONIAN.—650 horses are conveyed in transports to the seat of war at a cost for food of £1,542. A storm occurs just after one-fourth of the voyage is completed, in which 10 horses are killed. If the expense of the food of each horse be 1s. per day, what was the length of the voyage?—(*Barnard Smith.*)

(¼ No. of days × 650) + (¾ No. of days × 640)
= 1,542 × 20
(No. of days × 3¾⁵) + (No. of days × 480)
= 30,840
No. of days × 1285/2 = 30,840
∴ No. of days = 30,840 × 2/1285
= 48. Ans.

12. DERVI.—The specific gravity of lead is 11·324, of cork ·24, and of fir ·45; how much cork must be added to 60 lbs. of lead that the united mass may weigh as much as an equal bulk of fir?

(60 lbs. × 11·324) + (No. of lbs. of cork × ·24) =
(No. of lbs. of cork + 60 lbs.) × ·45
679·44 lbs. + (No. of lbs. of cork × ·24) =
(No. of lbs. of cork × ·45) + 27 lbs.
679·44 lbs. − 27 lbs. = (No. of lbs. of cork × ·45) −
(No. of lbs. of cork × ·24)
652·44 lbs. = No. of lbs. of cork × ·21
∴ No. of lbs. of cork = 652·44 / ·21
= 21744/21
= 3106⅔.
∴ Quantity of cork = 3106⅔ lbs.
= 1 ton 7 cwt. 2 qrs. 26⅔ lbs. Ans.

13. G. H., Stafford.—An estate is bought at 20 years' purchase for £20,000, three-quarters of the purchase-money remaining on mortgage at 4 per cent. The cost of repairs averaging £150 per annum, what interest does the purchaser make on his investment? (*Ever's 'Arithmetic.'*)

Annual rental = £20,000 ÷ 20
= £1,000;
Interest on mortgage = 4 per cent. on ¾ of £20,000
= 4 per cent. on £15,000
= £600;
Total payments = £600 + £150
= £750;
Interest for my outlay of £5000 = £1000 − £750
= £250;
∴ Rate of interest = £(250 × 100/5000)
= 5 per cent. Ans.

14. EPHEBUS.—There are two clocks, one of which gains 2 minutes per day, and the other loses 4 minutes per day. If both are started at noon, what time will the latter indicate, when the former (the fast clock) indicates 12 o'clock 12 days afterwards?

hrs. min. days. min.
24 2 : 12 :: x : Gain of fast clock
60 24
1442 288
721 60
17280(23 697/721 min.
1442
2860
2163
697

True time = 23 697/721 min. to 12 = 36 694/721 min. past 11;
12 days − 23 697/721 min. = 11 days 23 hrs. 36 694/721 min.
day. days. hrs. min. min.

$\therefore$ 1 : 11 23 $36\frac{24}{71}$ :: 4 : Loss of slow clock

24 24
24 287
60 60
1440 17256 (47 $\frac{72}{71}$ min.
360
2856
2520
336

$\left(336\frac{24}{71} = \frac{72}{71}\right)$

$\therefore$ Time indicated by slow clock = 11 hrs. $36\frac{24}{71}$ min. $- 47\frac{72}{71}$ min.
= 10 hrs. $48\frac{71}{71}$ min.
= $48\frac{23}{71}$ min. past 10,
or $11\frac{24}{71}$ min. to 11. Ans.

15. ERIC.—Find the value of:—

$$16 \times \left\{ \frac{1}{5} - \frac{1}{3 \times 5^3} + \frac{1}{5 \times 5^5} - \frac{1}{7 \times 5^7} + \text{etc.} \right\} - \frac{4}{239},$$

accurately to five places of decimals.

$\frac{1}{5} = \cdot2$

$\frac{1}{3 \times 5^3} = \frac{\cdot008}{3} = \cdot0026666$

$\frac{1}{5 \times 5^5} = \frac{\cdot00032}{5} = \cdot000064$

$\frac{1}{7 \times 5^7} = \frac{\cdot0000128}{7} = \cdot0000018$

$\cdot1973333$
$\cdot1973973$
$\cdot1973955$
16
11843730
197395·5
3·1583280
$\frac{4}{239} = \cdot0167364$
3·1415916

= 3·14159...Ans.

Algebra.

1. DOUBTFUL.—Simplify:—

$$\left\{x^{-\frac{3}{2}}y.\left(xy^{-2}\right) - \frac{1}{2}.\left(x^{-1}y\right) - \frac{2}{3}\right\}^3. \quad (Colenso.)$$

$$\left\{x^{-\frac{3}{2}}y.\left(xy^{-2}\right) - \frac{1}{2}.\left(x^{-1},\right) - \frac{2}{3}\right\}^3$$

$$= \left\{x^{-\frac{3}{2}}y \times x^{-\frac{1}{2}}y \times x^{\frac{2}{3}}y^{-\frac{2}{3}}\right\}^3$$

$$= \left\{x^{-\frac{4}{3}}y^{\frac{4}{3}}\right\}^3$$

$$= \underline{x^{-4}y^4}. \text{ Ans.}$$

2. INQUISITIVE.—Prove the following identities:—

(a) $(y+z-x)^2\,(z+x-y)^2\,(x+y-z)^2$
$= \{x^2-(y-z)^2\}\,\{y^2-(z-x)^2\}\,\{z^2-(x-y)^2\}$;

(b) $$\frac{\frac{s+p+t}{s+q+t}+\frac{s-p+t}{s-q+t}}{\frac{s+p+t}{s-q+t}+\frac{s-p+t}{s+q+t}} = \frac{(s+t)^2-pq}{(s+t)^2+pq}$$

(*Edinburgh University*, 1882.)

(a) $(y+z-x)^2\,(z+x-y)^2\,(x+y-z)^2$
$=(y+z-x)\,(y+z-x)\,(z+x-y)\,(z+x-y)\,(x+y-z)\,(x+y-z)$
$=(x+y-z)\,(z+x-y)\,(y+z-x)\,(x+y-z)\,(z+x-y)\,(y+z-x)$
$=(x+y-z)\,(x-y+z)\,(y+z-x)\,(y-z+x)\,(z+x-y)\,(z-x+y)$
$=\{x+(y-z)\}\,\{x-(y-z)\}\,\{y+(z-x)\}\,\{y-(z-x)\}\,\{z+(x-y)\}\,\{z-(x-y)\}$
$=\underline{\{x^2-(y-z)^2\}\,\{y^2-(z-x)^2\}\,\{z^2-(x-y)^2\}}$.

(b)
$$\frac{\frac{s+p+t}{s+q+t}+\frac{s-p+t}{s-q+t}}{\frac{s+p+t}{s-q+t}+\frac{s-p+t}{s+q+t}}$$

$$=\frac{(s+p+t)\,(s-q+t) + (s-p+t)\,(s+q+t)}{(s+p+t)\,(s+q+t) + (s-p+t)\,(s-q+t)}$$

$$=\frac{s^2+ps+2st-qs-pq-qt+pt+t^2+s^2-ps+2st+qs-pq+qt-pt+t^2}{s^2+ps+2st+qs+pq+qt+pt+t^2+s^2-ps+2st-qs+pq-qt-pt+t^2}$$

$$=\frac{2s^2+4st+2t^2-2pq}{2s^2+4st+2t^2+2pq}$$

$$=\frac{s^2+2st+t^2-pq}{s^2+2st+t^2+pq}$$

$$=\frac{(s+t)^2-pq}{(s+t)^2+pq}. \text{ Ans.}$$

3. B. O. Y.—A body of 7300 troops is formed of four battalions, so that $\frac{1}{2}$ of the first, $\frac{2}{3}$ of the second, $\frac{3}{4}$ of the third, and $\frac{4}{5}$ of the fourth, are all composed of the same number of men; how many men were there in each?

Let x = number of men in 1st battalion,

Then, number of men in 2nd battalion $= \frac{x}{2} \times \frac{3}{2} = \frac{3x}{4}$,

,, 3rd ,, $= \frac{x}{2} \times \frac{4}{3} = \frac{2x}{3}$,

,, 4th ,, $= \frac{x}{2} \times \frac{5}{4} = \frac{5x}{8}$;

$$\therefore\ x + \frac{3x}{4} + \frac{2x}{3} + \frac{5x}{8} = 7300$$
$$24x + 18x + 16x + 15x = 175{,}200$$
$$73x = 175{,}200$$
$$\therefore\ \underline{x = 2400}.$$

Number of men in 1st battalion = 2400
,, 2nd ,, $= \frac{3}{4}$ of 2400 = 1800
,, 3rd ,, $= \frac{4}{5}$ of 2430 = 1600
,, 4th ,, $= \frac{5}{8}$ of 2400 = 1500
} Ans.

4. CONSTANT READER.—Cloth, being wetted, shrinks up $\frac{1}{8}$ in its length and $\frac{1}{16}$ in its width. If the surface of a piece of cloth is diminished by $5\frac{3}{4}$ sq. yds., and the length of the four sides by $4\frac{1}{2}$ yds., what was the length and width of the cloth?

Let x = length in yards,
and y = width ,, ;

Then (1) $xy = \left(\frac{7x}{8} \times \frac{15x}{16}\right) + 5\frac{3}{4}$
(2) $2\left(\frac{x}{8} + \frac{y}{16}\right) = 4\frac{1}{2}$

(1) $xy = \frac{105x}{128} + \frac{23}{4}$
(2) $\frac{2x+y}{8} = \frac{17}{4}$

(1) $\frac{128xy - 105xy}{128} = \frac{23}{4}$
(2) $2x + y = 34$

(1) $\frac{23xy}{128} = \frac{23}{4}$
(2) $2x + y = 34$

(1) $xy = 32$
(2) $2x + y = 34$

(1) $8xy = 256$
(2) $\underline{4x^2 + 4xy + y^2 = 1156}$

Subtracting $4x^2 - 4xy + y^2 = 900$
$2x - y = 30$
(2) $\underline{2x + y = 34}$
Adding $4x = 64$
$\therefore\ \underline{x = 16}$

$\therefore$ Length = 16 yards, and width = 2 yards. Ans.

5. LOCUST.—One-half of a certain number of persons received 18d. each, one-third received 2s. each, and the rest received half-a-crown; the whole sum distributed was £2 4s.; how many persons were there?—(*Todhunter.*)

Let x = No. of persons,

Then $\left(\frac{x}{2} \times 18\right) + \left(\frac{x}{3} \times 24\right) + \left(\frac{x}{6} \times 30\right) = 44 \times 12$
$9x + 8x + 5x = 528$
$22x = 528$
$\therefore\ x = 24$

$\therefore$ No. of persons = 24. Ans.

6. FRONT-DE-BŒUF, Leamington.—Solve by Cardan's rule $x^3-3x^2-9x+20=0$.

$$x^3-3x^2-9x+20=0;$$

To eliminate second term, assume $x=y+1$,

$$(y+1)^3-3(y+1)^2-9(y+1)+20=0$$
$$y^3+3y^2+3y+1-3y^2-6y-3-9y-9+20=0$$
$$y^3-12y+9=0;$$

In the equation, $x^3+qx+r=0$, by Cardan's process,

$$x=\left(-\frac{r}{2}+\sqrt{\frac{r^2}{4}+\frac{q^3}{27}}\right)^{\frac{1}{3}}+\left(-\frac{r}{2}-\sqrt{\frac{r^2}{4}+\frac{q^3}{27}}\right)^{\frac{1}{3}};$$

Here, $r=9$, $q=-12$;

Hence we obtain,

$$y=(-\tfrac{9}{2}+\sqrt{\tfrac{81}{4}-64})^{\frac{1}{3}}+(-\tfrac{9}{2}-\sqrt{\tfrac{81}{4}-64})^{\frac{1}{3}}$$
$$=(-\tfrac{9}{2}+\tfrac{9}{2}\sqrt{-7})^{\frac{1}{3}}+(-\tfrac{9}{2}-\tfrac{9}{2}\sqrt{-7})^{\frac{1}{3}}$$
$$=(\tfrac{3}{2}+\tfrac{1}{2}\sqrt{-7})+(\tfrac{3}{2}-\tfrac{1}{2}\sqrt{-7})\ \{\text{Extraction of cube root of words.}\}$$
$$=3.$$

Thus 3 is a root of the equation $y^3-12y+9=0$.

The other roots can be found thus,

$$(y^3-12y+9)=(y-3)(y^2+3y-3);$$
$$y^2+3y-3=0$$
$$y^2+3y+(\tfrac{3}{2})^2=3+\tfrac{9}{4}$$
$$=\tfrac{21}{4}$$
$$y+\tfrac{3}{2}=\pm\tfrac{1}{2}\sqrt{21}$$
$$\therefore y=\tfrac{1}{2}(-3\pm\sqrt{21}).$$

Now, $x=y+1$

$$=3+1,\ \tfrac{1}{2}(-3\pm\sqrt{21})+1$$
$$=\underline{4,\ \tfrac{1}{2}(-1\pm\sqrt{21})}.$$

Note.—Consult *Todhunter's* 'Theory of Equations' for the process called Cardan's solution of a cubic equation.

7. T. M. J.—I pay into a Building Society 10s. 4d. every month; what shall I have paid in 20 years, reckoning Compound Interest at the rate of 5 per cent. per annum?

No. of payments $=13\times20=260$.

Let A be a month's payment, n the number of payments, R the amount of one pound in one month, M the required amount.

Then, $M=\frac{R^n-1}{R-1}A$; (*Todhunter's Algebra*, page 363.)

$$\therefore \text{Amount}=\left\{\frac{(\frac{241}{240})^{260}-1}{\frac{241}{240}-1}\times10\tfrac{1}{2}\right\}s.$$

$$\left\{\begin{aligned}\text{Log.}\left\{(\tfrac{241}{240})^{260}\right\}&=(\log.261-\log.260)\times260\\&=(2{\cdot}4166405-2{\cdot}4149733)\times260\\&={\cdot}0016672\times260\\&={\cdot}433472\\&=\log.2{\cdot}713138.\\&=\left(\frac{2{\cdot}713138-1}{\frac{1}{240}}\times10\tfrac{1}{2}\right)s.\\&=(1{\cdot}713138\times260\times10\tfrac{1}{2})s.\\&=4,602\,6376s.\\&=\underline{£230\ 2s.\ 7\tfrac{1}{2}d.}\quad\text{Ans.}\end{aligned}\right.$$

8. MATHEMATICIAN.—Solve:—

$$4a^2x=(a^2-b^2+x)^2.\ (\textit{Todhunter.})$$
$$4a^2x=(a^2-b^2+x)^2$$
$$=a^4+b^4+x^2-2a^2b^2+2a^2x-2b^2x$$
$$4a^2x-2a^2x+2b^2x-x^2=a^4+b^4-2a^2b^2$$
$$x^2-2a^2x-2ab^2x=-a^4-b^4+2a^2b^2$$
$$x^2-2(a^2+b^2)x=-a^4-b^4+2a^2b^2$$
$$x^2-2(a^2+b^2)x+(a^2+b^2)^2=a^4+2a^2b^2+b^4-a^4-b^4+2a^2b^2$$
$$=4a^2b^2$$
$$x-(a^2+b^2)=\pm2ab$$
$$\therefore x=a^2\pm2ab+b2$$
$$=\underline{(a\pm b)^2}.$$

General.

1. GARFIELD.—Form 17 (*a*) (*c*) is a memorandum from the Education Department to managers of schools, intimating that the next examination will be under the New Code.

2. E. DAWSON.—You will find the solution of your query in our issue for February (No. 12).

3. H. S. NOTTS.—(*a*) Yes. (*b*) Yes.

4. SELF-TAUGHT.—The natural sine means exactly the same as simply the sine. It is called *natural* to distinguish it from the *logarithmic* sine.

5. R. RYDER.—If you had examined the question (1st sum for females of the 4th year at the August examination), you must have noticed that £1200 was a misprint for £1250, as the latter amount is calculated in the solution.

6. J. W.—As the walk was made half way round the garden, it is evident that it must be taken from corner to corner, and therefore our solution is correct.

7. E. A. SAMPSON.—You will find all instructions on Stitching in Vol. I. of *The Governess*, or in 'How to Teach Plain Needlework,' published at 1s.

8. PECULIAR.—The sign = signifies that the numbers between which it is placed are equal; it is called the sign of equality. Thus, $3+2=5$, is read 3 added to 2 equals 5.

9. TOTA.—If you had taken the trouble to give the full working, you would not have found any difficulty in the solution as given in the text-book.

$$S=100(t-4)+10(t-4)^2$$
$$=100(t-4)+10(t^2-8t+16)$$
$$=100t-400+10t^2-80t+160$$
$$=10t^2+20t-240.\quad(\text{II.})$$

10. W. M. D.—Obtain solutions of the following equations:—

(*a*) $6\cot^2A-4\cos^2A=1$;

(*b*) $3\operatorname{cosec}^2A+8\sin^2A=10$. (*Todhunter.*)

(*a*) $6\cot^2A-4\cos^2A=1$

$$\left(6\times\frac{\cos^2A}{\sin^2A}\right)-4\cos^2A=1$$
$$\frac{6\cos^2A}{1-\cos^2A}-4\cos^2A=1$$
$$6\cos^2A-4\cos^3A+4\cos^4A=1-\cos^2A$$
$$4\cos^4A+3\cos^2A=1$$
$$\cos^4A+\tfrac{3}{4}\cos^2A=\tfrac{1}{4}$$
$$\cos^4A+\tfrac{3}{4}\cos^2A+(\tfrac{3}{8})^2=\tfrac{1}{4}+\tfrac{9}{64}$$
$$=\tfrac{25}{64}$$
$$\cos^2A+\tfrac{3}{8}=\tfrac{5}{8}$$
$$\cos^2A=\tfrac{5}{8}-\tfrac{3}{8}$$
$$=\tfrac{1}{4}$$
$$\therefore \underline{\cos A=\tfrac{1}{2}}.$$
$$\therefore \underline{A=60^\circ}.$$

(*b*) $3\operatorname{consec}^2A+8\sin^2A=10$

$$\left(3\times\frac{1}{\sin^2A}\right)+8\sin^2A=10$$
$$3+8\sin^4A=10\sin^2A$$
$$8\sin^4A-10\sin^2A=-3$$
$$\sin^4A-\tfrac{5}{4}\sin^2A=-\tfrac{3}{8}$$
$$\sin^4A-\tfrac{5}{4}\sin^2A+(\tfrac{5}{8})^2=\tfrac{25}{64}-\tfrac{3}{8}$$
$$=\tfrac{1}{64}$$
$$\sin^2A-\tfrac{5}{8}=\pm\tfrac{1}{8}$$
$$\sin^2A=\pm\tfrac{1}{8}+\tfrac{5}{8}$$
$$=\tfrac{1}{2}\text{ or }\tfrac{3}{4}$$
$$\therefore \sin A=\underline{\frac{\sqrt{3}}{2}\text{ or }\frac{1}{\sqrt{2}}}.$$
$$\therefore \underline{A=60^\circ\text{ or }45^\circ}.$$

11. T. PRICE.—Write to A. L. Vágo, 191, Gray's Inn Road.

12. SUBSCRIBER.—It would be almost impossible to give you the information within the limits of this column. You had better seek the advice of the nearest certificated teacher.

13. 3RD YEAR P.T.—We should say under the Old Code, but you had better write to the Inspector for your district.

14. ENQUIRER.—No such book is published. Any old student of the College would be glad to give you the information. You might also write to the Secretary for the rules, etc., of the College.

15. RALPHO, Arbroath.—Advanced grade.

16. NMIL.—(*a*) The lists will be published in March, but the results ought to be made known to your managers much earlier. (*b*) Now. (*c*) Back papers not published. (*d*) We are not aware that any other book on the subject is to be had.

17. GWALIA.—It is impossible to answer your queries, as the marks are not *now* published. They used to be.

18. CAITHNESSIAN.—(*a*) There is no sense in the words you ask us to parse. Send the context, and we will do what we can to help you. (*b*) See answer to *Gwalia*. (*c*) Yes. (*d*) Good, but rather too pointed.

19. G. F. J.—See answer to *Subscriber*.

20. HARVEY.—(*a*) Apply to the Secretary of the College you wish to enter. (*b*) Now, to the Secretary, Education Department, Whitehall, S.W.

21. JOE.—*Ross's 'Outlines.'* Mr. T. Murby, Bouverie Street, also publishes a very useful Manual, Pearce and Hayne's.

22. B. BIRCH.—The plan adopted in the columns of this journal is a good one. It might, however, be advisable to include the other heading.

23. GOODWIN.—Write to Messrs. Hachette and Co., Publishers, King William Street, Strand, stating exactly what you want, and they will, doubtless, forward you their catalogue. Mention this paper.

24. G. P. S.—We do not think any small cheap work has been published on the subject. So few take up Greek, that it would not pay a publisher to issue such a manual as you desire.

25. W. W., Deschanel.—Part IV. on 'Sound and Light,' 4s. 6d. (Blackie); or *Stone's* 'Elementary Lessons on Sound,' 3s. 6d. (Macmillan.)

26. AMICUS.—(1) *Dr. Smith's* 'Smaller History of Rome,' 3s. 6d. (Murray). (2) *Virgil's* 'Æneid,' with Notes by Charles Anthon, LL.D., 5s. (Tegg). (3) *Aveling's* 'Natural Philosophy for London University Matriculation,' 4s. (Stewart).

27. E. E. G.—*Johnston's* 'Civil Service Guide,' 3s. 6d. (Longmans). You will obtain much information from the Report of H.M. Civil Service Commissioners, which you may obtain through your bookseller, price 6s. 6d.

28. MEMBER OF THE BLUE RIBBON ARMY.—Mr. Lewis is quite correct; in fact, there is, as far as we can see, no other way of parsing the words you mention.

29. LILY WASNEY.—You will not find much difficulty in the stanza you quote if you take it in conjunction with the three which precede it, and remember that the poet is apostrophizing the Ocean.

30. PRECEPTOR.—You suffer from a plethora of good books. All you want, and more, may be obtained from those you mention.

31. A. J. P.—*Dr. Smith's* 'Principia Latina,' 3s. 6d. (Murray). 'The Sunday School Singer,' 6d. (Sunday School Union).

32. MATRICULATION.—The following are the present Examiners and Assistant Examiners in the subjects you specify, and in all probability they will retain their position. (*a*) Prof. W. G. Adams, M.A.; W. Garnett, Esq., M.A.; W. T. Goolden, Esq., M.A.; and S. L. Hart, Esq., D.Sc. (*b*) Professors H. Morley, LL.D., and A. W. Ward, LL.D.; W. A. B. Brewer, Esq., M.A.; and the Rev. C. V. Dasent, M.A.

33. DANEBURGH.—We cannot analyse the extract you give without knowing the context. Your writing requires care.

34. NANCE.—The analysis you require of the fifth line is as follows: *That's fair and square and perpendicular*, subordinate adjectival sentence, qualifying *candidate* in preceding line. *That*, subject; *is fair and square and perpendicular*, predicate.

Worsted goods are included under the more comprehensive term, *woollen goods*. *Worsted* (from Worstead, in Norfolk, where the manufacture of this article was first carried on by some Flemish refugees, in Henry II.'s reign) is a thread spun of rather long-stapled wool that has been combed, and which in the spinning is twisted harder than ordinarily.

[We regret to state that, owing to the pressure on our space, the answers to several queries must be held over till our next issue.]

THE Committee of the London Institute for the Advancement of Plain Needlework wish it to be distinctly understood that not only has the 'One-Thread Hemming' never been taught at the Institute, but that on all occasions it has been most strenuously objected to. The following is an extract from the Education Report, 1881-2, page 567.

'Needlework Examination, Training Colleges.

'In too many colleges one-thread system is in vogue. This is very objectionable, as it causes the actual stitch to be perpendicular, instead of in the correct position, oblique. It is also needlessly close for practical use, the great object being to teach students that which will be most useful to them as practical teachers.

'January, 1881. '(Signed) A. GRENFELL, Hon. Sec. to the London Institute.'

Publications Received.

Algebra—
(1) Algebra, with numerous examples, by F. S. Landon. W. Isbister,
(2) The Midland Algebra, Part I., and Answers. The Midland Educational Company, Birmingham.
(3) The Midland Algebraic Test Cards, Stage I. The Midland Educational Company, Birmingham.

Arithmetic—
(1) The Four Rules of Arithmetic, by W. Wooding, B.A. Longmans.

Domestic Economy—
(1) Science of Home Life, by Jerome Harrison, F.G.S. T. Nelson and Sons.

Elementary Classics—
(1) Vergil, Æneid I., by A. S. Walpole, M.A. Macmillan and Co.
(2) Ovid, Selections, by E. S. Shuckburgh, M.A. Macmillan and Co.
(3) Livy, Hannibalian War, by G. C. Macaulay, M.A. Macmillan and Co.
(4) Cæsar, Gallic War, Book I., by A. S. Walpole, M.A. Macmillan and Co.
(5) King Richard II., with Notes—'Blackie's School Classics.' Blackie and Son.

English Grammar—
(1) English Grammar, by Dr. R. Morris. Macmillan and Co.
(2) English Grammar, by F. A. White, B.A. Kegan, Paul, and Co.

French—
(1) Progressive French Course. First Year. Macmillan and Co.

Geography—
(1) The World at Home, for Standard II. T. Nelson and Sons.

German—
(1) Progressive German Course. First Year. Macmillan.

German Literature—
(1) Nicholson's Students Manual of German Literature. Swan Sonnenschein.

Greek—
(1) Manual of Greek Verbs, by F. Ritchie and E. H. Moore. Rivingtons'.

Health—
(1) Health Lectures for the People. Paper. John Heywood.
(2) Health Lectures for the People. Cloth. John Heywood.

Kinder-Garten Manuals—
(1) Baroness Marenholtz-Bülow's Handwork and Headwork. Swan Sonnenschein.

Latin—
(1) First Latin Grammar, by M. C. Macmillan, M.A. Macmillan and Co.

Magnetism—
(1) Treglohan's Magnetism. Longmans.

Maps—
(1) The Imperial Map of America. A. Johnston.
(2) A Map Illustrative of British History from the Norman Conquest to the close of the Civil Wars. T. Murby.

Mechanics—
(1) Elementary Mechanics, etc., by Jerome Harrison, F.G.S. T. Nelson and Sons.

Miscellaneous—
(1) In the King's Name, by S. Manville Fenn. Blackie.
(2) Under Drake's Flag, by G. A. Henty. Blackie.
(3) Facing Death: A Tale of Coal Mines, by G. A. Henty. Blackie.
(4) Winners in Life's Race: or, The Great Backboned Family, by A. P. Buckley. Blackie.
(5) First Readings: Christian Doctrine. Bemrose.
(6) Physical Education, and its place in a System of Rational Education. Swan Sonnenschein.
(7) Battle and Victory, by Mrs. Bowen. Griffith and Farran.
(8) The Adventures of the Pig Family. Griffith and Farran.
(9) Our Little Ones at Home and in School. Griffith and Farran.
(10) Fly Away Fairies, and Baby Blossoms, by Miss Clarkson. Griffith and Farran.
(11) Wee Babies, by Ida Waugh. Griffith and Farran.
(12) Proverbs in Sheets. A. Johnston.
(13) The Republic of Plato, by E. G. Hardy, M.A. Longmans.
(14) Object Teaching—a Lecture—by J. W. Gendstone, Ph.D., F.R.S. Macmillan.

(15) Recent Expedition to Eastern Polar Seas. Nelson and Sons.
(16) Homer's Stories Simply Told. Nelson and Sons.
(17) Ralph's Year in Russia. Nelson and Sons.
(18) Lost in the Backwoods. Nelson and Sons.
(19) In the Temperate Regions. Nelson and Sons.
(20) The Landseer Series of Picture Books, Nos. 1, 2, 3, 4. Nelson and Sons.
(21) Gulliver's Travels in the Kingdom of Lilliput. Nelson and Sons.
(22) Gulliver's Travels in Brobdingnag. Nelson and Sons.
(23) Old Mother Hubbard and her Dog. Nelson and Sons.
(24) Jack the Giant Killer. Nelson and Sons.
(25) The Baby's Museum; or, Mother Goose's Nursery Gems. Griffith and Farran.
(26) Alice through the Looking Glass. Swan Sonnenschein and Co.
(27) Stories from Old History. Swan Sonnenschein and Co.
(28) True to Himself. Swan Sonnenschein and Co.
(29) Tales from the Edda. Swan Sonnenschein and Co.
(30) African Discovery and Adventure. Swan Sonnenschein and Co.
(31) The Life of John Wiclif. Swan Sonnenschein and Co.
(32) The Book of Shadows. Swan Sonnenschein and Co.
(33) Cat and Dog Stories. Swan Sonnenschein and Co.
(34) Mrs. Wishing-to-be, etc. Blackie and Son.
(35) Our Dolly: Her Words and Ways. Blackie and Son.
(36) New Light through Old Windows. Blackie and Son.
(37) The Ball of Fortune. Blackie and Son.
(38) Nat, the Naturalist. Blackie and Son.
(39) Fairy Fancy. Blackie and Son.
(40) Brother and Sister. Blackie and Son.
(41) Water and its Teachings. Stanford.

Natural History—

(1) Common British Insects, by Rev. J. G. Wood, M.A. Longmans.

Needlework—

(1) Drawing Book Needlework, Schedule III. Griffith and Farran.

Periodicals and Magazines—

(1) Longmans' Magazine, No. 1. Longmans.
(2) Sports and Pastimes, Part 8. Cassell and Co.
(3) The Illustrated Bible for the Young, Part I. Ward, Lock and Co.
(4) The Child's Instructor; or, Learning made Easy, Part I. Ward, Lock and Co.
(5) The Universal Instructor, Part 25. Ward, Lock and Co.
(6) Our Little Ones. Vol. III. No. 1. Griffith and Farran.
(7) Gage's School Examiner. Gage and Co.

Readers—

(1) Blackie's Graded Readers, Standard VI. Blackie and Son.

Registers—

(1) The Complete Class Register, by Morgan and Bowker. The North of England School Publishing Company, Darlington.

Scripture—

(1) A Pocket Edition of the Parallel New Testament, containing versions 1611 and 1881. Cloth, red edges, 16 mo.
(2) A Pocket Edition of the Parallel New Testament, containing versions 1611 and 1881. Paste grain morocco, limp, 16 mo. Oxford University Press Warehouse.
(3) The Parallel New Testament, 1611 and 1881. Cambridge University Press Warehouse.

Teachers' Manuals—

(1) The Teachers' Manual of Object Lessons, by A. Park. John Heywood.

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Wisdom is humble that he knows no more.'—COWPER.

VOL. II. No. 11. JANUARY, 1883. PRICE 6D. POST FREE, 7½D.

School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

XI.

STRANGULATION OR SUFFOCATION, ACCIDENTAL OR SUICIDAL.

IT has occasionally happened that a boy has been accidentally hanged. Several such cases are mentioned in works on Forensic Medicine. Scott, the American diver, hung himself by accident in public, and no efforts were made to save him until too late. Children have often been found suspended in such ways as have pointed to the accidental nature of the result; but instances are not infrequent of children committing suicide by hanging themselves. Those in charge should know, therefore, the proper course to be pursued in such cases. Death may be produced by Asphyxia, either by strangulation or by suffocation. In strangulation the pressure of the cord upon the windpipe closes the air passages. But death may arise from Apoplexy, the pressure of the cord stopping circulation through the vessels, but not completely closing the windpipe; or it may be caused by fracture of vertebræ, and rupture of, or damage to, the spinal cord. The latter condition occurs when the body falls from a height, as happens when a person undergoes the last penalty of the law. In the latter case death is immediate; in the former it may be some time before that result arrives. It is not necessary, in order to ensure death by hanging, that the feet should be off the ground. The pressure upon the vessels may be sufficient to give rise to apoplexy or death by asphyxia even when the toes touch the ground. In other cases a person may faint in consequence of fright, or from other causes, and a tight ligature round the neck may accidentally become tighter and cause death by strangulation. Death may arise, therefore, from three different causes, of which a ligature round the neck may be the prime factor. In all cases of hanging the first thing to be done is to cut down the victim. It is curious, but this is not always done by the bystanders. People often run for assistance instead of at once cutting the cord, or raising up the body so as to loosen it between the neck and the object to which the cord is attached. It has happened on more than one occasion, that companions have run away for help, and left their friend to his fate, when a moment's thought, such as placing one's head and shoulders between the hanging person's legs and raising him up, so as to take the pressure off the cord, would have saved the sufferer from his untimely fate. If there are two persons at hand, one should do this whilst the other procures a knife or some other sharp instrument, if he has not one in his pocket, and cuts the cord as quickly as possible. Then all tight clothing about the neck and chest should be at once removed. If (as is probable) the head and face are frightfully congested, cold water may be dashed upon them, whilst the hands and feet are kept warm and dry. If a smelling-bottle or salts of ammonia are at hand, they may be applied to the nostril. But the most important thing to be done is to use artificial respiration in the same manner as is recommended in cases of drowning. It might be beneficial in certain cases in which apoplexy is imminent, for some blood to be taken from the arm, or even from the jugular vein; but this can only be done by a skilful surgeon. The indications are to set up respiration and to relieve the overloaded vessels, whilst cold effusion may be beneficial in emptying the gorged vessels in the head. The body must be kept warm. If blood is taken, it must be by a free blood-letting, for it is more for the purpose of relieving the pulmonary circulation than the threatening apoplexy. As in drowning so in hanging, there may be syncope or fainting, which may have preceded the act of strangulation. It is necessary, therefore, to continue artificial respiration as long as the least doubt remains as to the result. The heart may continue beating in a very indistinct and inaudible manner long after the pulse has ceased to be felt or the breath to be perceptible to ordinary observers. Be careful to free the mouth and throat from any possible foreign bodies. Death sometimes results from direct strangulation, by the forcible compression of the neck by thieves on the highway and which goes by the name of garotting. In these cases insensibility results from asphyxia or syncope; asphyxia results from the impediment to proper aeration of the blood, whilst syncope is the result of either fright or shock to the cardiac nerves. It is sometimes said that some anæsthetic, such as chloroform, had been used to aid the operation of the thief. But this is imaginary.

There is no anæsthetic in common use which can be of any service in the short time at the command of the thief; and when victims have detailed such an event it has been imaginary and not real. No reliance is to be placed upon the statement of those who assert that they were chloroformed before they were robbed.

SUFFOCATION BY CHOKING.

Accidents of various kinds may produce this result. I have known of more than one instance in which a lump of meat has gone into the trachea (or wind-pipe), instead of the pharynx (or gullet), and death has resulted. In every case of supposed apoplexy, or of any kind of fit, it is right to examine the throat, especially if the individual was eating at the time of the supposed fit. Suffocation results whenever air is prevented from entering the air passages. Children are often suffocated in bed by the clothes being drawn too tightly over their mouths either by accident or design. Coins have been put into the mouth for various purposes, and have accidently passed into the larynx and have produced suffocation. Pepper has led to choking by being drawn into the wind-pipe. When suffocation results from the presence of a foreign body, such as a lump of meat, or coins, or such like, introduce the finger into the throat as quickly as possible, and displace the offending body. A tallow candle may be used with effect to push it down if it is something which sticks in the gullet and compresses the wind-pipe. If the foreign body has entered the trachea there is nothing to be done unless a surgeon is at hand to open the wind-pipe and allow of respiration by that means. When suffocation is supposed to have resulted from smothering, artificial respiration and removal into fresh air are the proper means to be adopted in all cases. It is especially necessary to be sure that no foreign body is present in the throat, as a very small matter at the top of the wind-pipe may excite spasm and close the passage. If a candle is not at hand, a feather may be used, or any soft body which may act by displacing the offender. When a fish bone is the cause, it may be picked out by a pair of tweezers, or pushed down by the handle of a spoon. If a coin has entered the trachea, it might be beneficial to place the patient with the heels upwards, so as to allow the foreign body to drop back again by its own weight.

Action of Poisonous Gases.—The fumes of burning charcoal, the fumes from faulty stoves, the escape of coal gas into bedrooms, and of gases which are produced for the purpose of chemical experiment, sometimes give rise to serious accidents, and may cause death by suffocation. The indications for treatment in such cases are to get the patient into the fresh air, to promote respiration by artificial action, to relieve the venous congestion, supply fresh air, and to combat the tendency to death, according as it appears to be from asphyxia, or apoplexy, or syncope; bearing in mind that the danger in asphyxia is the absence of air in the lungs, and that there must be a free current of air around the patient, whilst artificial respiration is performed as regularly as possible; that the crowding of a number of people around the insensible person is increasing the danger; that pure air is a necessity. In asphyxia there is suspension of animation, with flushed or livid face, staring and congested eyes, and veins full to bursting, but pulse scarcely perceptible. In apoplectic tendencies there may be similar condition with stertorous breathing, that is, a noisy kind of breathing and flapping of cheeks, with a full pulse; artificial respiration will not be useful. In syncope there is palor rather than lividity, and death-like coldness, the limbs are flaccid, and the pulse, though extremely feeble and thread-like, may be felt occasionally. Artificial respiration is not so necessary as warmth and quietness, whilst the gentle application of ammonia to the nostrils, a little hot tea or sal-volatile and water by tea spoonfuls into the mouth, and the recumbent position, with an instant removal of all tight clothing, are the best means to be adopted to restore the suspended animation.

CEREBRAL OR BRAIN DISTURBANCE.

This class includes a number of cases which are pathologically and medically incongruous; but to the non-professional eye are very similar: they may be caused by accident or arise from disease.

They are *Concussion of the Brain*, from shock, either mental or physical. *Compresssion of the Brain*, from fracture of the skull-bones, or effusion within the cranical cavity. *Coma*, or unconsciousness which follows *Epilepsy*, or a certain kind of *Convulsion*, and the insensibility of *Intoxication*, on the sequence of *apoplexy*. Suspended animation of *syncope*. Some *hysterical conditions*, which may simulate either of the above, and *Catalepsy*, or *Trance*.

I propose to note the signs which distinguish the one from the other, and also the treatment to be pursued in each kind.

Concussion and Compression.—A person has a blow upon the head, as by falling down stairs, or from the branch of a tree; he may have fractured his skull, and some of the bony covering may have been drawn into the brain substance, or he may be suffering only from the effects of concussion. The blow may have temporarily suspended circulation through the brain, and the development of nerve force is stayed without having produced any physical damage to nerve substance. The symptoms of both Concussion and Compression are similar in the first stage. There is total insensibility; the pulse is feeble, perhaps intermittent, and the extremities cold. If death is not immediate, there is, after a short time, a slight warmth over the body; the pulse becomes more perceptible, and the breathing is sighing and irregular. Sometimes a vomit takes place, especially if there is fresh food in the stomach; the patient may talk for a short time in an incoherent manner, then open his eyes, which were closed, looks round with an astonished expression, and becomes himself again. This stage may occupy a few minutes, or it may last for some hours, and the patient come out of it very gradually. Slighter cases of Concussion simply stun the patient for a short time only. Vomiting is not a serious sign in severe cases; it is sometimes more significant in those apparently slighter cases, in which the patient expresses himself as all right again, and determines that there is nothing the matter with him. Great care is necessary in such cases to avoid excitement, to avoid heavy meals, and to get quiet sleep. Inflammation of the Brain may arise from the effects of the concussion, or there may be fracture of the skull from *contre-coup* without displacement. When such is the case there is headache, occasional vomiting, then feverishness, a stupid-looking state supervenes, and coma, or insensibility, comes on either gradually or suddenly after a convulsion. The symptoms which indicate compression may be manifest from the first, in consequence of the state of the

skull-bones, or from considerable bleeding from the ear, which is indicative of a fractured base of skull. In simple concussion there is no stertorous breathing, and the pupils are not irregular, and they act when light is thrown suddenly upon them; whilst in compression one or both pupils may be widely dilated, and are not sensible to the influence of light. When a person is first found, whether suffering from concussion or compression, he must not be raised up, but kept in the recumbent position, with the head raised not more than three inches from the ground on a wedge-shaped pillow, which may be made by a few articles of clothing or a folded blanket. In carrying such a case to the nearest house or place of refuge, great care must be used to avoid any increase to the damage by injudicious movement. If a stretcher can be procured from the nearest police station, so much the better; but failing that, it is easy to make one by means of a couple of poles, with a stout blanket, or a horse-cloth, or any material which can be attached to the poles, and tied by string, or rolled round them and stitched together, so that the latter are about two feet apart, and the patient then placed lengthways upon the cloth and carried by four persons, as bearers, not raising the patient on to the shoulders as is usually done, but keeping the poles at some eighteen inches from the ground and the bearers stepping together so as not to jar the patient. They should carry him head foremost and arrange for the taller persons of the party to take the foremost places. It is sometimes difficult to keep the poles from falling together; this may be obviated by two cross-bars between them about two feet long, which may be obtained from a forked branch of a tree, if a saw is not at hand to manufacture one from a piece of board. It is highly mischievous to place an injured person in a cab or cart for conveyance to the hospital, or to the house unless a proper arrangement has been provided, such as is in use in the ambulance waggons attached to the military service. The stretcher is by far the best means of conveyance in all cases of accident or unconsciousness. The fresh air which is obtained by movement will often be of service, whilst if care is used by the bearers to step all together, and the patient kept in the recumbent position as advised, no increased mischief will result to the case, whether it be from unconsciousness or fracture of any bone. Long-continued quiet, simple diet, and freedom from all exciting conditions, are especially necessary in all cases in which the head has been injured.

Every large school should have instruction in this method of carrying injured persons. The medical attendant should be asked to advise the boys upon it; an occasional ambulance drill, in which a boy should be carried on an improvised stretcher and the bearers taught to step together and carry their companion without jerk and by a steady movement, would save much suffering to the actually injured, and would be of more service in after life than much of the knowledge which is ordinarily taught in schools.

The *Coma*, or unconsciousness from *Apoplexy*, *Epilepsy*, or opium *Drunkenness*, are difficult to recognise or rather to diagnose the one from the other. If the two last are suspected in consequence of the smell of the breath, it is right to use the stomach pump, so as to withdraw the narcotic which may still be in the stomach, and prevent further absorption, and a medical man should be sent for to do this as quickly as possible. The skin is generally warm and dry and the pulse quick if the drunkenness is recent. The person can be roused somewhat, but in the coma which has been caused by apoplexy, or that which follows epilepsy, there is perfect unconsciousness, the pulse is irregular and slow, sometimes full instead of small. There may be flapping of the cheeks, dilated or irregular pupils of the eyes. If it is the sequence of an epileptic fit, there is a leaden aspect of skin, which is cold, perhaps clammy, and some bloody froth may be about the lips, showing that the tongue has been bitten. The coma from epilepsy is sure to pass away if the fits do not recur; it is quite unnecessary to give anything in any of these cases except a little cold water. The mischief which may be set up from forcing stimulant down the throat of a semi-conscious man or child is sometimes very great. Leave the patient in the recumbent posture, unfasten everything which is tight around the throat or the waist, keep the feet warm, and wait until the doctor arrives and indicates the proper thing to be done. More mischief is done by meddlesome assistants in these cases than can possibly arise from doing nothing. In opium poisoning the pupils are contracted, the pulse feeble, the respiration slow, and the skin cold; but the patient may be roused, and must not be allowed to sleep. He should be made to walk about until the stupor passes away.

A hysterical faint and cataleptic unconsciousness will be recognised by the quivering eyelids and lips, and the absence of those signs which indicate danger in the cases previously mentioned. They are better let alone, giving fresh air and effusing the face with cold water, and loosening all ligatures in clothing, but not wetting the dress. Cataleptic cases are not uncommon among schoolboys and girls; there is complete rigidity of the extensor muscles, the jaws are fixed and the eyelids closed and the skin cold (in hysterics it is warmer). When such cases occur in schools they should be transferred to the care of their friends, otherwise unconscious imitators may be found, and the disease become intractable. There is no immediate danger to the child, and it is not often that the fit comes on when no one is present to observe it.

(To be continued.)

Eminent Practical Teachers.

DAVID STOW,

Founder of the Training System of Education.

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

V.

THE 'simultaneous method' of answering was, as we have said, a distinguishing feature of the Glasgow System. For its most effective employment it assumed that 'the gallery' consisted of children of nearly the same stage of intellectual development. But though in many cases this ideal arrangement was not possible, the great majority in all schools could be always benefited by a gallery lesson on some ordinary topic. Even when, on account of deficiency of staff, subdivision was impossible, a small margin of 'little ones' did not very seriously interfere with the effect which the fresh thought, the vital energy, of a competent trainer unfailingly produced. Such a teacher never considered the *mere* mechanical 'answering together' of the mass of children, as the simultaneous method under

the Training System. If the replies thus given were not usually the result of thought; if the 'questions and ellipses mixed' did not ultimately lead the children to 'draw the inference,' to 'give the lesson,' themselves; if, in fine, under the guidance of the trainer, the 'gallery' did not come to a logical conclusion or 'make the application' of their own accord, the process was considered to be a failure. 'You must not expect all the children to answer at the same time' in the first instance, as 'each child will sympathize with that class of questions suited to his own natural cast of mind' (Hint 11), but the correct answers of the few were, by the skill of the trainer, to be made the property of all; and the question or ellipsis having been repeated in another form, a true 'simultaneous answer' was possible. These remarks are intended to refute the frequent assertion, that the simultaneous method is wholly mechanical. Under the Training System this was simply impossible. But we must defer a detailed exposition of the method to a future occasion, and content ourselves at present with this brief indication of its educational value. For its misapplication or its abuse Mr. Stow cannot be held responsible. He did not advocate that all the instruction in school should be derived from the 'trainer,' that no text-books should be used, and that the individual pupil should never attempt an independent effort. The acknowledged effect of the oral lesson in awakening the intelligence, and the apparent economy of the simultaneous method in regard to school staff, may, however, have led to strong prejudices in favour of the constant use of the gallery, for he ever maintained that 'the exercise of the faculties is the chief and important part of education, not the mere amount of knowledge imparted,' and he insisted that this exercise of the faculties was best stimulated by mental contact with the teacher. But though he thus urged the importance of teaching, he did not discourage *learning* as an effort on the part of the pupil.

Before entirely quitting this topic notice should be taken of the application of the simultaneous method to the art of reading aloud. 'Elocution is simply audible reading conducted in a clear, distinct, and proper manner,' and Mr. Stow contended that 'from the very earliest stage' the child should be trained to 'be an elocutionist.' Without entering into details as to the gallery drill, the uniform and advantageous mode of holding books, etc., it may suffice to say that large classes of children were trained on this method to 'articulate every syllable distinctly, and to read each word separately,' and with such variety of tone and inflection as to indicate an appreciation of the meaning. Perfect reading implies, of course, high intelligence, but this intelligence may exist without the power of vocal expression, which can only result from extensive practice. Reading together was thus undoubtedly economical as affording the requisite practice, and the imitation of the model rendering of an author by the teacher tended to secure an interest in literature which is but too rarely found in a certain class of children after they have left school. Individual and simultaneous exercises were mixed in the progress of each lesson, and there was thus a constant stimulus to attention and to excellence. The trainer was instructed to pause between the syllables; to 'rest firmly on the consonants;' to separate the words, and thus to read slowly, articulately, and emphatically. Phrase-reading, sentence-reading, and paragraph-reading, were the more advanced stages of a process of which pattern-reading was a prominent part.

All that pertains to the physical welfare of children at school was included in the Glasgow System. Mr. Stow was, in respect of sanitary matters, in advance of his contemporaries. The lofty halls erected for his schoolrooms, with ample provision for light and ventilation, formed a striking contrast to those of some school-houses, as well as to the homes of many of the children in the lower parts of the city. Spacious playgrounds, with 'swing-poles' and other gymnastic apparatus, were provided. In the schoolrooms, and between the lessons, there was marching to songs, in which all joined, and, with infants especially, 'physical exercises' were resorted to during a lesson, in order to give necessary relief to the body and recall the 'wandering eye.' 'A stronger sympathy exists between the intellectual, the moral, and the physical powers than is generally imagined. The great secret of securing the attention of children, and thereby training their mental and moral powers, lies in a proper and continued variety of physical or bodily exercise' (Hint 39). No lesson was begun, therefore, without 'drilling the troops in the gallery' and obtaining 'perfect silence,' with 'every eye fixed on the teacher.' The *infant* 'troops' always need most 'drilling,' and the little ones thus gain habits of order and prompt obedience—that is, of exact discipline. A clap of the hands or a purposely-excited laugh, 'lets off the steam' and 'prevents explosions' otherwise unavoidable. These are now accepted and common practices, at least, in infant schools, but they were systematically developed as a part of the Training System. Mr. Stow pointed out that these physical exercises might be used as an end; or, in regard to the intellectual training, as a means to an end, viz., to secure attention.

Cleanliness and neatness in the person, in the furniture, and in all the surroundings were always insisted upon; and the care of certain articles in the schoolroom or in the play-ground was a favour allowed to certain children in turn. 'Dirt and disorder' were unfamiliar. The Training School of necessity promoted the physical welfare of the children.

'All the improvements in education that of late years have appeared in England worth mentioning can be easily traced to the Glasgow Normal Seminary.' This was the declaration of the Marquis of Lansdowne, the Lord President of the Privy Council in 1848. Its absolute accuracy may perhaps be open to question; but, doubtless, the marvellous 'results' exhibited in the 'four departments' at Dundas Vale had led to inquiry on the part of earnest educationists, and to their subsequent adoption of some or of all the methods there employed. Attention was attracted to the Glasgow System not so much by the brilliancy of its intellectual developments as by the apparent efficacy of its moral power. The leaders of the several religious denominations thought they saw in the Moral Training System the ready means of accomplishing the main purpose of education, and procured from the Normal Seminary 'trainers' to carry out Mr. Stow's principles and methods in various parts of the world. Allusion has been made to the numbers of teachers sent by the Wesleyan body to Glasgow; but the Training Colleges at Cheltenham, Whitelands, Homerton, as well as Westminster, 'adopted and advocated the same prin-

ciples.' The marked differences of method which were formerly so prevalent have under the system of Government inspection largely disappeared; but even in the existing uniformity there remain, nevertheless, some of the distinctive characteristics of the Training System.

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

Author of 'Homes without Hands,' 'Nature's Teachings,' etc.

AND THEODORE WOOD,

Joint Author of 'The Field Naturalist's Handbook.

No. XXIII.—THE MARSUPIALS.

PART II.

WE now come to the second sub-family of the *Macropidæ*, or Marsupials, namely, the *Macropina*, which comprises the various Kangaroos. These are by far the most familiar of all the animals of the group, and present several important peculiarities of structure by which they may be readily recognised.

The most striking of these distinguishing characteristics we find in the structure of the hinder feet, which are always longer than those of the fore limbs, and are wonderfully adapted for purposes of leaping, in which exercise the kangaroos are singularly proficient. There are also various minor details of structure, such as the character of the dentition, etc., with which, however, we need not trouble ourselves.

THE first animal upon our list is the remarkable Tree Kangaroo (*Dendrologus ursinus*) of New Guinea, which, as its popular title implies, spends a considerable portion of its existence amongst the branches of trees. In this animal the hinder feet are not of such surprising length as is the case with the members of the typical genus, and are formed far more for ascending and descending the trunks of the trees in which it makes its home than for running or leaping upon level ground.

The fur, which is of a remarkably stiff and bristly nature, is of a deep jetty black upon the upper parts of the body, the under surface being of a yellowish or reddish-brown. The tail is wonderfully long, and appears to be of considerable service in assisting the animal to retain its balance while engaged in its arboreal evolutions. There is one very singular feature about this tail, namely, that it cannot be either twisted or curled. Consequently, when the animal is resting upon a branch, the tail hangs almost perpendicularly beneath it, thereby presenting a very strange and grotesque appearance.

The ease and rapidity with which so apparently a clumsy an animal can ascend and descend the trunks and traverse the branches of trees are simply astonishing, the creature seeming to move with almost the certainty and ease of the squirrel. Unfortunately, what little we know of its habits has been gathered chiefly from observations made upon captive animals, and we cannot, therefore, describe with any certainty its mode of life in a state of freedom. Its food appears to consist chiefly of young shoots, bark, berries, and leaves, procured from the trees in which it takes up its abode.

There was a very fine Tree Kangaroo in the Zoological Gardens about 1865 or 1866. A tree trunk with large branches was placed diagonally in its cage, and every spectator was struck with the curious sight which it presented as it leaped up and down from the branches to the trunk and back again, seldom coming on the floor of the cage.

WE now come to the true Kangaroo (*Macropus major*), which far exceeds in size the preceding species. Indeed, an adult male kangaroo is a really large animal, measuring fully seven feet six inches from the nose to the tip of the tail, of which the body occupies considerably more than half. The tail, too, is unusually large, generally measuring eleven or twelve inches in circumference at the base.

This tail is used for a somewhat curious purpose, serving, together with the hinder limbs, to support the animal when sitting upright.

The dentition of the kangaroo is somewhat remarkable, the lower front teeth projecting forwards. They are lancet-shaped, nearly flat, double edged, and each edge is serrated, like the teeth of the shark. An experienced kangaroo hunter told me that these teeth are used like sickles for cutting grass, the kangaroo holding the grass together with its forepaws, and then sawing the stems asunder with its sharp-edged teeth.

The female kangaroo is very much smaller than her mate, the difference in size, in fact, being so remarkable, that the two animals might well be supposed to belong to two distinct species. Six feet, indeed, appears to be a limit seldom or never exceeded by the female, while in weight, also, she is far inferior to her lord, who averages from one hundred and fifty to one hundred and sixty pounds. In both sexes the fur is of a brown hue mingled with grey, the lower part of the body being of a rather lighter tint. The forepaws and the tip of the tail are black.

The kangaroo can scarcely be termed a gregarious animal, and yet assembles in small flocks, each of which is composed of seven or eight members. Even these bands, small as they are, do not appear to be closely united, the animals which compose them generally feeding at some little distance from one another, and seeming to act upon no preconcerted plan in cases of danger, as is the case with animals in general.

Owing to the value of its flesh and skin, the kangaroo is in great demand both with natives and colonists, who persecute and destroy it in every possible manner. With the former, pit-falls and snares are frequently brought into requisition, while the latter generally make use of the more legitimate methods of pursuit. Indeed, in many districts, a kangaroo hunt is one of the staple forms of amusement, dogs being specially kept and trained for the chase, just as are foxhounds in England. Nor is the sport altogether without its dangers, for an adult male kangaroo, or 'boomer,' as it is generally termed, is by no means a despicable antagonistic for the most powerful and active dogs; or, indeed, for a human being not provided with fire-arms.

The mode of fighting adopted by the kangaroo when fairly brought to bay is rather peculiar. Placing its back against some tree, in order that it may not be attacked from behind, it awaits the onslaught

of the dogs, who are, generally, only too eager to rush upon their foe.

No sooner does one of them come within reach, however, than a sudden sharp stroke is delivered by one of the hinder feet, which, being armed with a long and sharp claw, are capable of inflicting very severe wounds. Indeed, instances are by no means unusual of a dog being completely ripped up by a single stroke from the terrible foot of the kangaroo. In this manner a kangaroo will often keep at bay a whole pack of dogs, their combined efforts being insufficient to drive the animal from its post of vantage.

These claws are so long, and strong, and pointed, that they are used as heads for spears. It seems hardly fair to use the kangaroo's claw for the purpose of killing the kangaroo, but the Australian is obliged to do so, just as the Esquimaux kill the walrus with a spear headed with walrus ivory.

Except as a last resource, however, the kangaroo seldom fights, preferring to trust to its fleetness rather than to the formidable weapons with which nature has provided it. When chased, it often evinces the most remarkable cunning in its attempts to throw its pursuers off the track—attempts which are not always unattended with success.

One of the most favourite of these stratagems consists in a sudden and violent leap at right angles to the track. The anima lthen lies quietly among the brushwood until the hounds have passed by its place of concealment, when it noiselessly makes off in another direction.

With such violence is this sidelong leap taken, that in more than one case the leg of the animal has been broken by the severe strain suddenly laid upon it.

One of these animals, which was brought to bay, actually seized with its fore-paws the dog which was leaping at its throat, sprang to a river that was within a short distance, and held the dog under water until it was drowned.

As a general rule, the 'boomer,' or male kangaroo, is alone useful for purposes of the chase, the female usually giving but little trouble to the hounds, and not unfrequently dying of sheer terror without receiving the slightest injury. When quite young, however, she will sometimes afford very fair sport, her wonderful speed earning for her the title of 'Flying Doe.'

The bounds by which the animal progresses are of really wonderful length, the more so when we consider the rapidity and seeming ease with which they are made. Mr. Gould tells us that the spring of a full-grown 'boomer' was found to measure exactly fifteen feet, and that the distances between the footprints were as regular as if they had been stepped off by a sergeant.

The power of making these extraordinary bounds is owing entirely to the structure of the hinder feet, which are exceedingly long in proportion to the remainder of the limb. Unless the animal be alarmed, however, it proceeds in a far more deliberate and somewhat clumsy manner, balancing itself upon its broad and powerful tail, and swinging the hinder limbs forward much after the fashion of crutches. It is often imagined that the large and powerful tail forms an important auxiliary to these hinder feet in making the lengthy bounds for which the animal is so famous. This, however, is not the case, that organ seeming to be only employed in supporting the animal when sitting erect, and in assisting it to retain its equilibrium while leaping through the air.

THE largest of the *Macropidæ* is the Woolly Kangaroo (*Macropus laniger*), so called from the peculiar texture of the fur, which bears a considerable resemblance to cotton-wool. In size, this animal considerably exceeds the last-described species, an adult male averaging as much as eight feet and two or three inches in total length.

From the common kangaroo it may be easily distinguished by the colour of the fur, which is of a reddish-yellow hue, changing to grey upon the head and shoulders. The toes are covered with short black hairs. A white patch is found at the sides of the mouth, and, in the female animal, extends as far as the eyes. This species is an inhabitant of Southern Australia.

NEXT upon our list of Marsupials comes the celebrated Rock Kangaroo (*Petrogale penicillata*), which is, among rocks and precipices, very much what our common native squirrel is among trees.

The rapidity with which the animal will make its way over seemingly impassable crags is said to be truly marvellous. Once amidst the rocky ground in which it delights to dwell, it can set at defiance its two chief enemies, namely, the dingo, or wild dog, and the native hunter, its wonderful speed and activity enabling it to traverse ground where pursuit is out of the question.

Even should the hungry native succeed in tracking it to its lair, he gains but little advantage thereby, for the rock in which its retreat is usually situated is generally of so hard a nature as completely to set at defiance the rude tools possessed by the savage hunter, while the various exits with which it is always provided allow the smoke to pass through without disturbing the inmate, should its would-be captor resort to the use of fire.

It is, indeed, very seldom the case that the rock kangaroo will allow itself to be captured without considerable difficulty, save and except upon the occasional instances when it basks in the sunbeams, and abandons itself entirely to the enjoyment of the genial warmth. Upon such occasions it is so completely absorbed in its luxurious occupation that it may be approached and slain with comparatively little difficulty.

Although selecting by preference rough and broken ground for its usual haunts, this kangaroo appears to be quite at its ease among trees, ascending and descending the trunks with considerable facility, provided that they be not perfectly perpendicular.

The rock kangaroo is a far smaller animal than either of its above-described relatives, a full-grown male only measuring a little more than four feet in total length. The tail is furnished at the extremity with a tuft of long bristly hairs, which has sometimes earned for the animal the title of 'Brush Kangaroo.' The fur, which is of a purplish grey hue, is of no great value, its texture being decidedly coarse, and unfitting it for use in the purposes for which the skins of its congeners are employed.

THE Brush-tailed Bettong, or Jerboa Kangaroo (*Bettongia penicillata*), is of very much smaller dimensions than any of the preceding animals, scarcely equalling, even when fully adult, an ordinary English hare in size. It is a pretty and graceful little creature, bearing a strong resemblance in general appearance to

the Kangaroos themselves, to which animals, indeed, it is very closely related. In many particulars, however, it differs from the Macropina already described, the head being short and broad, and the tail endowed with considerable prehensile power. The colour of the fur is a pale brown, pencilled with white, the lower portions of the body being of a somewhat lighter hue. The extremity of the tail, which is decorated with a tuft of longer hairs, is black.

This pretty little animal does not reside in crevices of rocks, etc., after the manner of the rock kangaroo, but constructs for itself a dwelling in a somewhat singular manner. Taking advantage of some natural hollow in the ground, it scoops out the soil until a convenient depth is attained. The next step is to cover this hollow with a roofing of grasses, etc., so arranged that it exactly coincides in height with the tops of the surrounding vegetation. This is so ingeniously managed by the animal that, except to the practised eye of the native hunter, which immediately detects the slightest inequality among the herbage, it is almost invisible, the work being so neatly performed that scarcely a sign betrays the presence of the cleverly constructed domicile.

The animal conveys the materials selected for her nest to the site of the intended dwelling in a somewhat curious manner. First procuring a considerable quantity of leaves, grasses, etc., she forms them into a kind of sheaf, round which she twists her tail, hopping off, thus laden with her burden, to the nest. As soon as the material thus collected is used, she sets off in search of a second supply, and so on until the requisite quantity has been obtained.

This animal is extremely common in New South Wales, but, owing to its nocturnal habits, is comparatively seldom seen, except by those who go in search of it. In spite of its small size it is wonderfully active, and will travel over the ground at a really wonderful speed should it be pursued or otherwise alarmed. When hard pressed it has, like the kangaroo itself, a curious habit of leaping off suddenly at right angles to its course, and concealing itself in some crevice, in the hope of escaping the observation of its pursuer.

IN the Kangaroo Rat (*Hypsiprymnus minor*), or Potoroo, as it is termed by the natives, we have one of the transitional links between the *Macropina* and the animals composing the next group of the marsupials, the general kangaroo form and appearance being preserved, while the power of leaping, and also of manipulating food and other objects with the fore-paws, is altogether wanting. It is true that the animal is able to sit upright, after the fashion of the kangaroos, supporting itself by a kind of tripod formed of the hinder limbs and the tail. Here, however, the resemblance ceases, the mode of progression employed by the potoroo consisting of a curious gallop, very different from the powerful bounds of the preceding animals.

The title of Kangaroo Rat is due to the nature of the tail, which is covered with scales, between which proceed a number of scattered hairs. It is not a very large animal, the total length being only some twenty-eight inches, of which rather more than one-third is occupied by the tail.

The Kangaroo Rat is tolerably plentiful throughout New South Wales, and, not being so exclusively nocturnal in its habits as is the Brush-tailed Bettong, is far more often seen. It feeds chiefly upon roots, which it extracts from the ground by means of its powerful claws, which form very efficient weapons for tearing up the soil.

Owing to the nature of its food, the potoroo is a terrible nuisance upon cultivated land, often causing severe loss to the agriculturist by its ceaseless ravages. The potato seems to be a particular favourite article of diet with the animal, which continues its depredations day after day in spite of the attempts which are made to check its destructive proceedings.

THE Kangaroo Hare (*Lagorchestes leporoides*) is not at all unlike the animal from which it derives its popular title—colour, form, and habits being so remarkably hare-like that the name of kangaroo hare is singularly appropriate. The fur is close, hard, and slightly curled.

When alarmed, the kangaroo hare can run with the most marvellous celerity, often baffling even the best hounds by its wonderful speed, and also by the facility with which it doubles when closely pursued. Although usually progressing by means of a rapid gallop, it is by no means destitute of leaping abilities, and, should occasion require, will often execute the most wonderful bounds.

The kangaroo hare appears seldom or never to be found in the neighbourhood of the sea-coast, but seems to be confined to the interior of the country, where it is tolerably abundant.

With the kangaroo hare we must conclude our account of the members forming the group of the kangaroos, and shall in our next paper proceed to describe some further examples of this curious tribe of animals, which form one of the most interesting of all the great families into which the mammalia are divided.

BEFORE doing so, however, we will cast a glance at the 'marsupium,' or pouch, from which these animals derive their scientific name.

Many zoologists doubt whether the name is a satisfactory one, because the pouch is nothing more than a fold of skin, and there are many undoubted marsupials in which the pouch is practically non-existent, a mere wrinkle marking its position. The peculiarities of the marsupial structure are more internal than external, and, moreover, belong more to the young than to the adult animal.

It is impossible to describe the structure fully without the use of many and elaborate diagrams; but I will mention one or two of the most remarkable details.

No matter how large or how small the marsupium may be, the marsupial bones are always present. Even in the duck-bill, or platypus, and echidna, the marsupial bones are present, though the animals are not in any respect marsupials, but belong to a totally different order. Moreover, the marsupial bones are found in both sexes, though, of course, the male possesses no pouch.

Now we come to a very remarkable structure in the immature marsupial.

When introduced into the pouch it is affixed to one of its mother's teats in such a way that instead of receiving the teat into its mouth, its head seems to be drawn over the teat. At this period of life the young

one has not sufficient muscular power to enable it to suck, and the milk is continually forced down its throat by the compression of certain muscles peculiar to these creatures.

Now, if the structure of the young marsupial—say a kangaroo—were like that of other mammals, the little creature would be choked by the flow of milk; so the entrances to the respiratory and nutritive organs are separated by the modification of certain portions of the throat into a valve, which permits the milk to flow continuously down the throat while the channel of respiration is kept open.

The structure of this portion of the immature marsupial is almost identical with that of the whale tribe.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

'PARALLELOGRAMS of forces and of velocities.' This somewhat ambitious title would lead many to consider that the subject treated of was rather outside the limits of elementary instruction. Nothing, however, ought to be so considered which is fairly within the mental capacity of our scholars. And that this subject can be grasped by ordinary fifth and sixth standard boys, I have had abundant proof. I may mention, as a fact, that on the occasion of my giving the first lesson upon it, I asked a boy to come out and draw a line to show the direction of the resultant of two forces whose directions I had indicated on the blackboard; and the lad drew a line which I found, on completing the parallelogram, to be exactly coincident with the diagonal; so clearly did he perceive the nature of the subject. The truth is, the general principles or laws which are observed in the workings of nature around us, can be made clear to boys, just in proportion to the clearness with which the teacher himself perceives those laws. I am attending a course of lectures by Professor Seeley, and I cannot but note the enormous difference between his demonstration of a truth and that of our ordinary certificated science teachers. When listening to some of the latter, how soon it becomes manifest that their knowledge of the subject reaches just as far as the last page of the sixpenny text-book, and no farther.

Instead of reproducing a lesson, I will, in this article, endeavour to make clear what is meant by parallelogram of forces. Force is that which produces motion. It is measured by the amount of momentum it communicates. Momentum is compounded of mass and velocity. Weight is a measure of mass. Velocity is measured by the space passed over in a certain time. Now all those truths must be entirely understood before pupils are able to grasp anything concerning parallelogram of forces. It must here be understood that we speak of mechanical force only, not of heat force, or electric force, or chemical force. Let us take a mass of matter weighing 4 lbs. Let the number 4 represent such mass. It moves at a velocity, say, of 3 ft. per second. Good. Now we will compound the mass and velocity. Multiply 3 by 4, answer 12. Then 12 is a number which represents the momentum of a certain moving body. But the momentum of a body is a measure of the force which has communicated that momentum. Therefore, the number 12 may stand to represent a force. Again, take another mass weighing 3 lbs. Let its velocity be 2 ft. per second. Then the number which will represent its momentum will be 6, which may represent the force that has communicated this momentum. Here, then, we have two momenta, represented relatively by the numbers 12 and 6; and we say the first momentum is double of the second. Also we have two forces represented relatively by the same numbers. I have entered into these preliminaries somewhat in detail, because I so frequently hear and read such phrases as the following:—'let a force of 4 lbs. act;' 'let the line AB represent the direction of a force of 12 lbs.,' and so on. Now are not such statements misleading? What is a force of 4 lbs.? Can there be such a thing as 4 lbs. of force? I cannot conceive of such. Of course, when we wish to represent the relativity of different forces, we may let numbers or lines stand for their magnitudes or intensities.

If two forces of equal magnitude act simultaneously from exactly opposite directions upon a given point, they entirely neutralize each other; or in more correct language they are entirely converted into a resultant of heat force; with which at present we have nothing to do.

If two forces, from different but not exactly opposite directions, act simultaneously upon a certain point, the resultant, both as to direction and intensity, may be represented by the diagonal of a parallelogram whose sides represent respectively the two forces. This is a statement of the parallelogram of forces. I need not, however, proceed further with the subject, as all the ordinary text-books fully explain it.

This article concludes the series on the methods I have adopted for teaching the Fourth Schedule Subject, 'Mechanics.' I trust that those of my readers who have not yet taken up the subject as a 'special' will be induced to do so. Not that they will necessarily follow the lines I have laid down, for it is a subject that admits of an endless variety of treatment. In those articles I have confined myself more to the principles involved and of the methods of demonstrating those principles, rather than to their application to any of the practical businesses of life. But if I taught in a manufacturing centre, I should certainly arrange a syllabus for mechanics that would bear intimately upon the special industry of the locality. Suppose, for instance, my school were in Bermondsey. The syllabus should be framed so as to include the structure of skin, the nature of the various skin-coats of the pachydermata; something respecting the natural history of those animals whose hides yield leather; the chemistry of tanning, including the nature of tannic acid, and its action upon the gelatino-fibrous substance of the true skin; the sources of 'tannin,' whether as barks and other raw parts of trees, or as extracts such as 'gambir,' 'japonica,' etc. All these subjects might be taken in addition to the elementary principles of natural philosophy given in the code. And I am quite convinced, no inspector would object to such a syllabus, although it would not be at all points strictly coincident with the official syllabus. If

my school were at Burton-on-Trent, then I would arrange the work to include the scientific principles involved in brewing; and not a boy should leave my sixth standard without having the fact demonstrated beyond all manner of question, that the main business of the brewer was to utterly spoil vast quantities of valuable barley. To such an extent may we impart what is generally understood as technical knowledge. Still, however, we must not lose sight of the fact that science-teaching in our schools should always be educative rather than technical. That our chief work is not so much to turn out good tanners and brewers as to develop that general intelligence which will surely prove to be the primary element of success in whatever position of life our scholars may hereafter find themselves.

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.

One sum each (A and B) dictated, the rest taken from the blackboard.

A.		B.	
3401		5214	
511		612	
8		3	
4060		4820	
7980	Ans.	10649	Ans.
4016		8321	
2109		4119	
1907	Ans.	4202	Ans.
8164		7421	
298		390	
7866	Ans.	7031	Ans.

Spelling.

Table, chair, eye, house, butter.
Where is the man with his stick?
Jacket, shoe, mouth, head, cheese.
There are two great black dogs with their master.

STANDARD II.

A. A girl had 201 pins in a box. She gave 57 to her mother, 72 to her brother. How many had she left? Ans. 72.

9)17001	38,714	14,601
Ans. 1889	680	2,978
	26,325,520 Ans.	11,623 Ans.

B. I gave a girl 54 apples, a boy 73, and had 28 left. How many had I at first? Ans. 155.

9)16929	54,316	59,742
Ans. 1881	94	14,894
	5,105,704 Ans.	44,848 Ans.

STANDARD III.

(1) Find the difference between £29 os. 6½d. and £20,010 18s. 7¾d. Ans. £19,981 18s. 1¾d.
(2) Divide 960,001 by 469. Ans. 2046—427.
(3) When a girl left school she had given her a prize of £5. She bought a pair of boots for 10s., paid 8s. 11d. for calico, 9s. 6d. for dress material, and 6s. for dressmaking. What had she left?
Ans. £3 5s. 7d.
(4) Add together (given partly in *words*) £29 os. 5d., £10,011 18s. 6¾d., £1985 17s. 9½d., £2009 16s. 11¼d., and £853 19s. 6¾d.
Ans. £14,890 13s. 3¼d.

STANDARD IV.

(1) Reduce a million oz. to tons.
Ans. 27 ton 18 cwt. 0 qr. 4 lb.
(2) Reduce 1 ton 2 cwt. to lbs. Ans. 2464 lb.
(3) A man earned 24 shillings weekly. He spent 19s. 7½d. a week. How long would he be saving £6 10s. 4d.? Ans. 29 weeks, and 3s. 5½d. left.
(4) £18 19s. 7½d. × 621. Ans. £11,787 7s. 1½d.

STANDARD V.

(1) Find by practice the value of 9017 suits at £3 16s. 4d. each. Ans. £34,414 17s. 8d.
(2) A grocer bought 5 cwt. 2 qrs. of tea for £71 17s. 4d., of which 7 lbs. were spoiled. What would he gain or lose by selling the rest at 2s. 7½d. a lb.?
Ans. £8 1s. 3½d. gain.
(3) A bill:—13½ lb. of cheese at 8d. a lb., 3 boxes of figs (2½ lb. each) at 7d. a lb., 4 doz. oranges at 1½d. each, 9 boxes of tapers at 2s. 3d. per dozen boxes, ¾ lb. of tea at 4s. 4d. a lb., and 17 lb. of bacon at 10½d. a lb. Ans. £1 19s. 2¼d.
(4) A man who works 10 hours a day does a piece of work in 4½ days; how many hours would he have worked each day if he had taken 8 days? Ans. 5⅝.

STANDARD VI.

(1) Find the value of $\frac{1}{3}+2\frac{1}{2}+4\frac{3}{4}+\frac{15}{16}+\frac{2}{7}$ of $3\frac{1}{2}$ of $\frac{1}{8}$.
Ans. $8\frac{3}{16}$.
(2) After spending $\frac{5}{16}$ of my money, I have 7s. o½d. left. How much had I at first? Ans. 9s. 9d.
(3) Add together ·75 of 20s., ·75 of a guinea, ¾ of a crown, and ·125 of 24s. Ans. £1 17s. 6d.
(4) Find by practice the value of 36 cwt. 2 qr. 14 lb. of spice, at £7 11s. 6d. per cwt.
Ans. £277 8s. 8¼d.
(5) If a man can walk a certain distance in 1 hr. 18 min. 45 sec. by taking 76 steps a minute, how many steps a minute must he take to walk the same distance in 1 hr. 3 min.? Ans. 95.
(6) Find the value of $1\frac{3}{11}-\frac{4}{7}$, and of $1\frac{3}{11}\div\frac{4}{7}$, and reduce each answer to a decimal.
Ans. ·70129+; 2·2272̇7̇.

Grammar.

STANDARD III.

Select nouns, verbs, adjectives, adverbs, and pronouns, in the piece given for dictation.

STANDARD IV.

(Parse the whole sentence).

(A) In our school stood a very old-fashioned clock with a brass face.

(B) We never came to school without taking a slight glance at our pets.

(C) We saw the old man with his youngest son by his side.

STANDARD V.

(Analyse and parse the words in italics.)

(A) *There* in the *shadow* of *old* Time
The halls *beneath* thee *lie*,
Which poured forth to the fields of yore
Our England's chivalry.

(B) *How bravely and* how solemnly
They stand 'midst oak and yew,
Whence Crecy's yeomen *haply formed*
The *bow in* the battle true.

Composition.

STANDARD VI.

(A) What occupation would you choose to follow after you leave school? Give reasons for your choice.

(B) Write an account of two ways in which you would spend a holiday.

—o—

ANSWERS TO

Pupil Teachers' Examination Papers.

Nov. 25TH, 1882.

CANDIDATES.

Three hours and a half allowed for this paper.

Arithmetic.

MALES.

1. Find by practice the value of 6 tons 11 cwt. 1 qr. 24 lbs. at £1 18s. 6d. per cwt.

		£	s.	d.
Value of 1 cwt.	=	1	18	6
				131
,, 131 ,,	=	252	3	6
,, 1 qr. = ¼ value of 1 cwt.	=	0	9	7½
,, 16 lb. = ¼ ,, ,,	=	0	5	6
,, 8 ,, = ½ ,, 16 lb.	=	0	2	9
		£253	1	4½. Ans.

2. If the rates on a house, of which the rent is £63, be £9 16s. 3d., what is the rent of a house on which the rates amount to £11 8s. 11½d.?

£9 16s. 3d. : £11 8s. 11½d. :: £63 : ?
or or
4710 halfd. 5495 halfd.

$$\frac{£63 \times 5495}{4710} = \frac{£346185}{4710} = £73\ 10s.\ \text{Ans.}$$

3. If 24 men can build a wall in 40 days, and 6 men leave after 4 days, in how many days will the remaining men finish the wall?

18 men : 24 men :: 36 days : time required.

$$\frac{36 \text{ days} \times 24}{18} = 48 \text{ days. Ans.}$$

4. If 8 cwt. 14 lbs. be carried 30 miles for 10s. 6d., how far should 19 cwt. 2 qrs. be carried for the same money?

19½ cwt. : 8½ cwt. :: 30 miles : ?

$$\frac{30 \text{ miles} \times 65 \times 2}{8 \times 39} = 12\tfrac{1}{2} \text{ miles. Ans.}$$

5. If 12 men and 6 boys do a piece of work in 22 days of 8 hours each, in how many days of 9 hours each would 16 men and 4 boys do the same, 2 men doing as much as 5 boys?

12 men = 30 boys.
16 ,, = 40 ,,

44 boys : 36 boys
9 hs. : 8 hs. } :: 22 days : ?

$$\frac{22 \text{ days} \times 36 \times 8}{44 \times 9} = 16 \text{ days. Ans.}$$

FEMALES.

1. Make out the following bill:—81 lbs. tea, at 2s. 11d. per lb.; 99 lbs. coffee, at 1s. 7½d. per lb.; 54 lbs. cocoa, at 1s. 5d. per lb.; 243 lbs. rice, at 2½d. per lb.; 31 lbs. 8 oz. butter, at 1s. 10d. per lb.; 63 lbs. loaf sugar, at 7½d. per lb.; 108 lbs. moist sugar, at 3½d. per lb.; 38 lbs. 4 oz. bacon, at 10d. per lb.; 55 lbs. 2 oz. cheese, at 8d per lb.

		s. d.		£	s.	d.
81 lbs.	tea	at 2 11 per lb.	...	11	16	3
99 ,,	coffee	,, 1 7½ ,,	...	8	0	10½
54 ,,	cocoa	,, 1 5 ,,	...	3	16	6
243 ,,	rice	,, 0 2½ ,,	...	2	15	8½
31½ ,,	butter	,, 1 10 ,,	...	2	17	9
63 ,,	loaf sugar	,, 0 7½ ,,	...	1	19	4½
108 ,,	moist do.	,, 0 3½ ,,	...	1	11	6
38¼ ,,	bacon	,, 0 10 ,,	...	1	11	10½
55½ ,,	cheese	,, 0 8 ,,	...	1	16	9
				£36	6	6¼ Ans.

2. Find the cost of 14,773 ac. 2 roods of land at the rate of £63 10s. 6d. per acre.

		£	s.	d.
Cost of 14,773½ ac. at £1	=	14,773	10	0
				63
,, ,, £63		930,730	10	0
,, ,, 10s. = ½ at £1	=	7,386	15	0
,, ,, 6d. = 1/20 at 10s.	=	369	6	9
		£938,486	11	9 Ans.

3. What is the value of one thousand four hundred and ninety-one articles at £32 11s. 1d. each.

		£	s.	d.
Value of 1,491 arts. at £1 each	=	1,491	0	0
				4
		5,964	0	0
				8
,, ,, £32 ,,	=	47,712	0	0
,, ,, 10s. ,, = ½ v. at £1	=	745	10	0
,, ,, 1s. ,, = 1/10 ,, 10s.	=	74	11	0
,, ,, 1d. ,, = 1/12 ,, 1s.	=	6	4	3
		£48,538	5	3 Ans.

4. Find the cost of 30 cwt. 3 qrs. 9 lbs. 12 oz. at £16 6s. 8d. per cwt.

		£	s.	d.
Cost of 1 cwt.	=	16	6	8
				30
,, 30 ,,	=	490	0	0
,, 2 qrs. = ½ cost of 1 cwt.	=	8	3	4
,, 1 ,, = ½ ,, 2 qrs.	=	4	1	8
,, 8 lbs. = ¼ ,, ,,	=	1	3	4
,, 1 lb. = ⅛ ,, 8 lbs.	=	0	2	11
,, 8 oz. = ½ ,, 1 lb.	=	0	1	5½
,, 4 oz. = ½ ,, 8 oz.	=	0	0	8¾
		£503	13	5¼ Ans

Grammar.

1. 'Two brothers once did weeping part
On the edge of the sea so blue;
The one was fair and false at heart,
The other was gallant and true.'

(*a*) Point out and parse all the verbs and adjectives in the above.

(*b*) How do you know that the words 'the one' and 'the other' in the above are not adjectives?

(*a*) *Two*—numeral adj. numbering 'brothers.'
did part—intrans. reg. verb, indic. past indef. (=parted) 3rd pers. plur. agr. with subj. 'brothers.'
weeping—irreg. trans. verb *weep, wept, wept*, incomplete part. having an adverbial force, and at the same time attributive to 'brothers.'
blue—adj. qual. 'sea.'
was—irreg. intrans. *am, was been*, indic. past indef. 3rd. pers. sing. agr. with 'the one.'
fair—predic. adj. qual. 'one.'
false— ,, ,, ,, 'one.'
was—same as above, agr. with 'the other.'
gallant— } predic. adjs. qual. 'the other.'
true— }

(*b*) 'the one' and 'the other' are not adjectives because they may be declined thus:—

sing.		sing.	
Nom.	one	Nom.	other
Poss.	one's	Poss.	other's
Obj.	one	Obj.	other.

We can say, 'The *one's* heart was false, and the *other's* true.' Adjectives are not declinable words.

2. What kinds of adjectives admit of comparison? What do not?

Adjectives of quality and quantity, whose signification can be increased or diminished, admit of comparison.

Adjectives of distinction, and those whose signification cannot be increased or diminished, do not admit of comparison. As: *right, left, wrong, square, two, three, this.*

Geography.

Answer either Q. 2 or Q. 3, not both.

1. What is meant by the basin of a river? Illustrate your answer by referring to the basin of the Severn, describing the counties' drained by it, and naming in order its principal tributaries.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it with all the tributaries up to the water-parting of each.

The basin of the Severn commences at Plynlimmon, and is separated from that of the Thames by the Cotswold Hills; the Edge Hills separate it from that of the Great Ouse; and the Clent Hills divide it from the basin of the Trent. On the west the basin of the Severn is bounded by the Clee Hills, the Malvern Hills, and the hilly district of the Dean Forest.

The Severn flows through Montgomery, the best wooded country in Wales, very mountainous except along the valley of the Severn; through Shropshire, a rich agricultural county abounding in coal and iron; through Worcester, a county rich in grain, salt springs, and manufactures of porcelain, carpets, etc.; and through Gloucester, a fine county, rich in grain, fruit, and pasturage, with the remains of the ancient Forest of Dean in the west, rich in coal and iron mines.

The tributaries of the Severn are the Vyrnwy, the Teme, the Avon, the Wye, the Usk, and the Lower Avon.

2. Describe minutely a voyage from Newcastle-on-Tyne to Stirling.

Leaving Newcastle, a great coal port, and passing North and South Shields, we touch Tynemouth, and turn north to Coquet Isle and Holy Island, above which are the Fern Isles, opposite Bamborough Castle, which stands upon a bold cliff south of Berwick. Berwick, at the mouth of the Tweed, was long independent of both England and Scotland. When we pass that town we are on the coast of the county of Berwick, skirting which we pass the lofty lighthouse on St. Abb's Head and Tantallon Castle, Dunbar, and round into the Firth of Forth, passing the Bass Rock, North Berwick, Prestonpans, with its salt manufacture, Musselburgh, Portobello, Leith (the Port of Edinburgh), Granton, a rival to Leith, Queensferry, Bo'ness, Grangemouth, Alloa, noted for its ales, and reach our destination, Stirling.

3. Where are the following articles made:—Silk goods, stockings, lace, gloves, needles, porcelain? Name towns as well as counties, and describe the situation of each.

Silk goods—*Spitalfields* (London); *Manchester*, on the Irwell in Lancashire; *Macclesfield*, in Cheshire; *Coventry*, in Warwick; *Derby*, on the Derwent.
Stockings—Leicester on the Soar; Derby; Nottingham, near the Trent.
Lace—Nottingham; Derby; Tiverton and Honiton, in Devonshire; Buckinghamshire.
Gloves—Worcester; Yeovil, in Somerset; Woodstock, in Oxford.
Needles—Chiefly at Redditch, in Worcestershire.
Porcelain—North of Staffordshire; Derbyshire; Leeds, on the Aire, in Yorkshire; Worcester.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline.*

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

FIRST YEAR.

Pupil Teachers at the end of First Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. Divide $2\frac{3}{4} + 3\frac{3}{5}$ of $1\frac{1}{4}$ by $5\frac{1}{2}$ of $1\frac{1}{3} - \frac{2\frac{1}{2}}{4\frac{7}{11}}$

(*a*) $2\frac{3}{4} + 3\frac{3}{5}$ of $1\frac{1}{4} = 1\frac{1}{4} + \frac{11\times9}{3\times5} = \frac{55+132}{20} = \frac{187}{20}$

(*b*) $5\frac{1}{2}$ of $1\frac{1}{3} - \frac{2\frac{1}{2}}{4\frac{7}{11}} = \frac{11\times4}{2\times3} - \frac{17\times11}{8\times51} = \frac{22}{3} - \frac{11}{24} = \frac{176-11}{24} = \frac{165}{24}$

Dividing (*a*) by (*b*) $= \frac{187\times24}{20\times165} = \frac{1122}{1100} = \underline{1\frac{11}{50}}$ Ans.

2. What fraction of $\frac{6\frac{1}{2}+5\frac{1}{3}}{5\frac{1}{2}-4\frac{2}{3}}$ of 3s. 4d. is 2s. $10\frac{3}{4}$d.?

(*a*) $6\frac{1}{2} + 5\frac{1}{3} = 11\frac{7}{13}$; $5\frac{1}{2} - 4\frac{2}{3} = \frac{1}{24}$

(*b*) $11\frac{7}{13} \div \frac{1}{24} = \frac{139\times24}{12\times11} = \frac{372}{11}$

(*c*) $\frac{2\text{s. } 10\frac{3}{4}\text{d.}}{\frac{372}{11} \text{ of 3s. 4d.}} = \frac{139 \text{ fars.} \times 11}{160 \times 278} = \underline{\frac{11}{320}}$ Ans.

3. Give a rule for finding the decimal point in dividing one decimal by another.

Divide 29·5625 by 6·25; ·295625 by 625; and 295625 by ·625.

Rule.—Divide as if the divisor and dividend were whole numbers. If the number of places in the dividend exceed the number in the divisor, cut off from the quotient as many decimal places as are equal in number to this excess, prefixing ciphers if necessary.

If the number of places in the dividend is less than the number of places in the divisor, affix ciphers to the dividend until the number of places in the dividend equals the number of places in the divisor; the quotient up to this point of the division will be a whole number; if there be a remainder, and the division be carried on further, the figures in the quotient after this point will be decimals.

(a)

6·25)29·5625(4·73 Ans.
25 00
4 562
4 375
1875
1875

(b)

625)·295625(·000473 Ans.
2500
4562
4375
1875
1875

(c)

·625)295625(473000 Ans.
2500
4562
4375
1875
1875

4. Express $1\frac{2}{3}$ of £1 17s. 10½d. as the decimal of £5, and find the value of ·428571 of 2½ guineas.

(a) $\frac{\frac{5}{3}\text{ of £1 17s. 10½d.}}{£5} = \frac{103\frac{1}{2}}{180} = \underline{\cdot 606}$. Ans.

(b) ·428571 of 52½s. $= \frac{3 \times 105}{7 \times 2} = \underline{22\text{s. } 6\text{d.}}$ Ans.

5. Show that $\frac{\cdot 729 \times 1\cdot 345}{\cdot 027 \text{ of } 2\cdot 083} = 17\cdot 28$.

$$\left(\tfrac{7}{10}\tfrac{2}{0}\tfrac{9}{0} \times 1\tfrac{4}{10}\tfrac{3}{0}\tfrac{2}{0}\right) \div \left(\tfrac{2}{10}\tfrac{7}{0}\tfrac{0}{0} \times 2\tfrac{7}{10}\tfrac{5}{0}\tfrac{5}{0}\right)$$

$$= \frac{729 \times 1332 \times 990 \times 900}{999 \times 990 \times 27 \times 1875}$$

$$= \frac{432}{25} = \underline{17\cdot 28}. \text{ Ans.}$$

FEMALES.

1. A person's salary is £383 5s. for 365 days; in how many days will he have a claim for £63?

£383¼ : £63 :: 365 days : ?

$\frac{365 \text{ das.} \times 252}{1533} = \underline{60 \text{ days.}}$ Ans.

2. A bankrupt having £645 5s. 3½d. left, can pay seven shillings and eight pence halfpenny in the pound. What is the amount of his debts?

7s. 8½d. : £645 5s. 3½d. :: £1 : debts.
or or
185 halfd. 309727 halfd.

$\frac{£1 \times 309727}{185} = \underline{£1674\text{ 4s.}}$ Ans.

3. If 16 men, working 8 hours a day, can reap 9 acres in 3 days, how much land can 20 men, working 6 hours a day, reap in the same time?

16 men : 20 men
8 ho. : 6 ho. } :: 9 ac. : ?

$\frac{9 \text{ ac.} \times 20 \times 6}{16 \times 8} = \frac{135 \text{ ac.}}{16} = \underline{8 \text{ ac. } 1 \text{ ro. } 30 \text{ po.}}$ Ans.

4. 6 horses eat 18 guineas' worth of hay in 6 weeks when hay is 9d. a stone, what is its price per stone when 15 horses eat £110 5s. worth in 21 weeks?

15 horses : 6 horses
378s. : 2205s. } :: 9d. : ?
21 wks. : 6 wks.

$\frac{9\text{d.} \times 6 \times 2205 \times 6}{15 \times 378 \times 21} = \underline{6\text{d.}}$ Ans.

Grammar.

1. 'Not wholly in the busy world, nor quite
Beyond it, blooms the garden that I love;
News from the humming city comes to it,
In sound of funeral or of marriage bells;
Although between it and the garden lies
A league of grass, washed by a slow, broad stream,
That stirred by languid pulses of the ear,
Waves all its lazy lilies.' TENNYSON.

(a) Point out all prepositions in the above, and show what words they govern.

(b) Parse the word 'that' as it is used in the second and seventh lines.

(c) Which words in the above are adverbs? Show that they are such.

PREPOSITIONS.

(a) *In*	gov.	'world'	*of*	gov.	'bells.'
beyond	,,	'it'	*between*	,,	'it' and 'garden.
from	,,	'city'	*of*	,,	'grass.'
to	,,	'it'	*by*	,,	'stream.'
in	,,	'sound'	*by*	,,	'pulses.'
of	,,	('bells')	*of*	,,	'ear.'

(b) 'that' in second line is a simple rel. pron. referring to 'garden,' 3rd pers. sing., neut. obj. gov. by 'love.'
'that' in seventh line is a simple rel. pron. refer. to 'stream,' 3rd pers. sing., neut. nom. subj. of 'waves.'

(c) '*Not*' is an adverb, because it modifies another adv., 'wholly.'
Rule:—Adverbs modify verbs, adjectives, and other adverbs.
'wholly,' adv., because it modifies the verb 'blooms.'
'quite' ,, ,, ,, the adverb phrase 'beyond it.'

2. The words *except*, *notwithstanding*, are sometimes used as prepositions, sometimes as conjunctions. Give examples of their use in each capacity.

'They all perished *except* one' (prep.)
'*Except* ye repent, ye shall all likewise perish' (conj.).
'*Notwithstanding* his good character, they dismissed him' (prep.).
'The loss of a few ounces of blood may do no harm, *notwithstanding* it will weaken a person at the time' (conj.).

Geography.

Answer either Q. 2 or Q. 3, not both.

1. Draw a full map of Russia in Europe. Insert the lines of latitude and longitude.

2. What is a river-basin? Illustrate your answer by referring to the basins of the Severn and the Danube, describing minutely the courses of those rivers, and their principal tributaries.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it, with all the tributaries up to the waterparting of each.

The basin of the Severn commences at Plynlimmon, and is separated from that of the Thames by the Cotswold Hills; the Edge Hills separate it from that of the Great Ouse; and the Clent Hills divide it from the basin of the Trent. On the west the basin of the Severn is bounded by the Clee Hills and the hilly district of the Dean Forest.

Rising in Plynlimmon, the Severn flows almost due north through the vale of Montgomery until it enters the plain of Salop, where it is joined by the *Tern*, flowing from Staffordshire. The Severn now turns to the south and flows through a valley bounded on one side by the Wrekin and Clent Hills, and on the other by the Clee and Malvern Hills. It is now joined by the waters of the Stour and Teme. The Teme rises in Plynlimmon and has a quick descent to the main stream. Soon after entering Gloucestershire it receives the Avon, which rises at Naseby, in Northampton, and joins the Severn after a course of 100 miles. The course of the Severn is now very winding as far as Gloucester, where it meets the tide.

The basin of the Danube, which embraces an area of nearly 300,000 square miles, is bounded by the Alps, the Balkans, the Carpathians, the Riesen-gebirge Mountains, the Bohemian Forest, and the Schwartz Wald.

The Danube from the heights of the Black Forest in Baden flows eastward through Hohenzollern, Wirtemberg, Bavaria, and Archduchy of Austria, E. and S. through Hungary, and enters Turkish territory at Belgrade. It continues E., forming the boundary of Turkey, separating Servia from Hungary, and Bulgaria from Wallachia, and falls into the Black Sea.

It receives on its right the Iller, the Leck, the Iser, and the Inn, all from the Tyrolese Alps; the Drave from the E. of the Tyrol, and the Save from Carinthia; it receives on its left bank

the Naab from the Bohemer Wald, the Morava from Moravia, the Waag from the borders of Silesia, and the Theiss from the Carpathian Mountains. In Turkey it receives the Morava from Servia, the Isker from Sophia, and the Pruth from Buckovina.

3. Say what you know about the government of the different countries of Europe; and explain the terms, *Absolute Monarchy*, *Limited Monarchy*, *Republic*, *Confederation*.

The form of government is in general *Limited* Monarchy; the exceptions are Russia and Turkey, which are *Absolute*, Austria being nearly so; France is a *Republic*, and Switzerland a *Federal Republic*.

A Limited Monarchy is a country governed by a king or queen, whose acts are controlled by laws made by an assembly of national representatives, like the British Parliament.

An Absolute Monarchy is a country whose ruler is not limited by any controlling assembly.

A Republic is a country governed by rulers chosen by their fellow-citizens, the chief ruler being generally styled President.

A Federal Union or Confederation is a union of several independent states for the purpose of better securing common interests, each state managing its own internal affairs independently of the others.

History.

1. How many kings named William have governed England? Gives dates of their accession and death.

Four kings of the name of William have governed England, namely:—

William I.	began to reign	1066	died 1087
William II.	,,	1087	,, 1100
William III.	,,	1689	,, 1702
William IV.	,,	1830	,, 1837

2. Name the queens who have reigned in England, with the length of each reign.

Mary I.	reigned for 5 years	(1553-58)
Elizabeth	,, ,, 45 ,,	(1558-1603)
Mary II.	,, ,, 5 ,,	(1689-94)
Victoria has	,, ,, 45 ,,	(1837-82)

3. Give names and dates of the sovereigns who reigned between 1460 and 1550.

Henry VI.	was reigning	1460	deposed 1461.
Edward IV.	reigned from	1461	till 1483.
Edward V.	reigned for a few months in		1483.
Richard III.	,, from	1483	till 1485.
Henry VII.	,, ,,	1485	,, 1509.
Henry VIII.	,, ,,	1509	,, 1547.
Edward VI.	,, ,,	1547	,, 1553.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline*.

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. At what rate per cent., simple interest, will £375 12s. 6d. amount to £460 2s. 9½d. in 5 years?

Interest = (£460 2s. 9½d. − £375 12s. 6d.) = £84 10s. 3½d.

£375½ : £100 } :: £84 10s. 3½d. : rate
5 yrs. : 1 yr }

$$\frac{£84\ 10s.\ 3\tfrac{1}{2}d. \times 100 \times 8}{3005 \times 5} = £4\tfrac{1}{2}\ \text{p.c.}$$ Ans.

2. Find the compound interest on £2,533 6s. 8d. for 2½ years at 3 per cent. per annum.

3 p. c. per annum gives $\frac{3}{100}$ of principal for interest to be added at the end of each year, and $\frac{1}{100}$ for one-third of a year.

$\frac{3}{100}$	2,533	6	8	
	76			
$\frac{3}{100}$	2609	6	8	Amount for 1st year
	78	5	7·2	
$\frac{1}{100}$	2687	12	3·2	,, ,, 2nd ,,
	26	17	6·272	
	2714	9	9·472	,, ,, 2½ years.
deduct	2533	6	8	
Compound interest =	181	3	1·472	Ans.

3. On what sum of money will the simple interest in 3 years 219 days at 4 per cent. per annum amount to £685 8s. 9½d.?

£4 : £685 8s. 9½d. }
3¾ years : 1 year. } :: £100 : Sum required.

$$\frac{£685\ 8s.\ 9\tfrac{1}{2}d. \times 100 \times 5}{4 \times 18} = £\tfrac{2\,4\,7\,1\,9\,2}{3\,6} = £4760$$ Ans.

4. A money-lender gets 15s. for the loan of £24 for 5 calendar months. What rate per cent. per annum does he get for his money?

£24 : £100 }
5 mos : 12 mos } :: £¾ : rate

$$\frac{£\tfrac{3}{4} \times 100 \times 12}{4 \times 24 \times 5} = 7\tfrac{1}{2}\ \text{p.c.}$$ Ans.

5. What percentages of 5 are 20, 3½, ·02, and 1¼?

$$5 : 100 :: \left\{\begin{matrix} 20 \\ 3\tfrac{1}{2} \\ \cdot 02 \\ 1\tfrac{1}{4} \end{matrix}\right\} : \left\{\begin{matrix} 400. \text{ Ans.} \\ 70. \text{ Ans.} \\ \tfrac{2}{5}. \text{ Ans.} \\ 25. \text{ Ans.} \end{matrix}\right.$$

FEMALES.

1. Find the least common multiple of 225, 255, 289, 1023, and 4095.

5	225,	255,	289,	1023,	4095.
3	45	51			819
3	15	17		341	273
17	5				91
		1	17		

∴ L.C.M. = 5 × 3 × 3 × 17 × 5 × 17 × 341 × 91
= 2,017,790,775. Ans.

2. Reduce the following compound fraction to a simple one: ⅘ of ⅞ of ⅘ of 70⅝ of $\frac{5}{16}$ of $1\frac{7}{11}$ of 147

⅘ of ⅞ of ⅘ of 70⅝ of $\frac{5}{16}$ of $1\frac{7}{11}$ of 147 =

$$\frac{5 \times 3 \times 6 \times 632 \times 3 \times 18 \times 147}{7 \times 8 \times 7 \times 9 \times 40 \times 11} = \frac{2\,8\,4\,9}{1\,1}$$

3. Divide $3\frac{1}{4} - \frac{5}{8}$ of $\frac{5}{12}$ by $21\frac{1}{3} + \frac{5}{12} + 4\frac{1}{2}$ of 5

(*a*) $3\frac{1}{4} - \frac{5}{8}$ of $\frac{5}{12} = \frac{13}{4} - \frac{5}{8} = \frac{117 - 8}{36} = \frac{109}{36}$

(*b*) $21\frac{1}{3} + \frac{5}{12} + 4\frac{1}{2}$ of $5 = 21\frac{1}{3} + \frac{45}{2} = \frac{129 + 130}{6} = 24\frac{1}{6}$

(*c*) $\frac{109}{36} \div 24\frac{1}{6} = \frac{109 \times 6}{36 \times 259} = \frac{109}{1554}$. Ans.

4. What fraction of a sovereign is $4\frac{1}{3}\frac{1}{1} - 10\frac{1}{4}\frac{1}{4} + 9\frac{5}{24} - \frac{11}{117}$ of a penny?

(*a*) $4\frac{1}{3} + 9\frac{1}{11} = 13\frac{12}{11} + 1 = 13\frac{1}{11}$; $13\frac{1}{11} - 10\frac{1}{4} = 13\frac{1}{11} - 10\frac{1}{4} = 2\frac{1}{11}\frac{1}{4}$; $2\frac{1}{11}\frac{1}{4} - \frac{5}{24} = 2\frac{42 - 20}{45} = 2\frac{22}{45}$.

(*b*) $2\frac{22}{45}$d. to the fraction of a sov. = £$\frac{112}{45 \times 240}$ = £$\frac{7}{1\,1\,7\,0}$. Ans.

Grammar.

1. 'It is not *dying* for a faith *that* is *so hard*, *but* living *as if* it *were* a *reality* to us.'

(*a*) Analyse the subordinate sentences in the above, pointing out to which class each belongs.
(*b*) Parse the words in italics.
(*c*) Show from the above what kind of conjunctions are followed by the subjunctive mood, and give other examples.

(*a*) (1) 'That is so hard' subord. adj. sent. qual. the fact 'dyihg for a faith.'
(2) 'As if it were a reality to us,' subord. adv. sent. modif. 'living.'

	(1)	(2)
Subject	'*that*' and	'*it*.'
Predicate (incomplete)	'*is*' ,,	'*were*.'
Completion of Pred.	'*so hard*' ,,	'*a reality to us*.'
Connective	'*that*' ,,	'*as if*.'

(*b*) *dying*—verbal noun or gerund. nom. after 'is' in apposition with 'it.'
that—simple rel. referring to 'dying for a faith,' sing., neut., nom., subj. of 'is.'
so—adv. of deg. mod. 'hard.'
hard—predic. adj. qual. 'that.'
but—advers. co-ord. conj. contrasting the two principal members of the compound sentence.
as if—conj. phrase, or compound subord. conj. of condition connecting a subord. sent. to a principal.
were—irreg. intrans. verb, *am*, *was*, *been*, subjunctive, past indef., 3rd pers. sing., agr. with subj. 'it.'
reality—abstr. noun, neut., sing., nom. after 'were.'
(*c*) The subjunctive mood is generally used after hypothetical or conditional conjunctions: *e.g.*, '*as if* it were a reality'; 'I fear *lest* he come'; 'except he give us permission we dare not go.'

2. Distinguish between (present) participles and gerunds; give some examples of the use of the latter.

The (present) participle always qualifies a noun either attributively or predicatively, and the gerund or verbal noun, though also ending in -ing denotes action or state, and may be used as the subject or object of a sentence. It may also govern an objective case.

Participles.	*Gerunds.*
A *rolling* stone.	The *rolling* of the ship.
A *running* sore.	In *running* along.
The *gleaming* sun.	The *gleaming* of the sun.

Geography.

Answer two Questions.

1. Draw a full map of Russia in Europe. Insert the lines of latitude and longitude.

2. Give full notes of a lesson on Malta.

POSITION.—Situated in the Mediterranean, 58 miles S. of Sicily, and 179 miles from the N. point of Africa.
EXTENT AND CHARACTER.—Little else than mere rock—stretches from N.W. to S.E.—length 18 miles—greatest breadth 10 miles—area about 95 sq. miles—about two-thirds cultivated—most of it made productive by sheer industry—climate excellent, allowing two crops every year—no streams—few springs—rain-water collected in tanks.
TOWNS AND PEOPLE.—*Valetta*, on N.E. coast (60,000), clean, handsome town, with one of the finest harbours in the world—very strongly fortified—a port of call for vessels to India. *Maltese*, strong and hardy—make excellent seamen—famous for making lace and jewellery—speak an Arabic dialect—are Roman Catholics.
PRODUCTIONS.—No forest trees or hedges—wild thyme in the west feeds bees, which produce famed Maltese honey—whole crop of corn lasts inhabitants only three months. *Cotton* is the chief production. Vines and olives are cultivated, figs and oranges abound, and the vegetables are excellent. The asses of Malta are celebrated.
IMPORTANCE.—From its position, commercial and military, it can scarcely be over-valued. Commanding the southern coast of Europe, it is the rendezvous for the British fleet stationed in the Mediterranean, and along with Gibraltar prevents the closing of the route to our Indian possessions.
HISTORY.—Possessed by the Knights of St. John from 1530; it was taken by the French in 1798, and these again were driven out by the English in 1800, from which time it has remained a British possession.

3. Say what you know about British Columbia, the Mackenzie, the Great Slave Lake, Melville Sound, Hudson Straits, Baffin's Bay, and Cape Sable.

N.B.—If you do *not* answer Q. 1, draw little sketch-maps in illustration of 2 or 3.

British Columbia is a colony of British North America, forming part of the Dominion of Canada. The climate is somewhat similar to Britain, and its soil is well suited for agriculture. The country is well wooded and mountainous. New Westminster is an important town on the Fraser river.
The Mackenzie (and Athabasca united) rises in the Rocky Mts., flows N. and N.W. through British America, and falls into the Arctic Ocean. Their united length is 2,300 miles, and area of basin 600,000 sq. miles.
On this river are the three great expansions of Athabasca, Slave, and Great Bear Lakes.
The Great Slave Lake is an expansion of the Mackenzie River, in British North America, about 300 miles long.
Melville Sound is one of a line of straits leading from Baffin's Bay westward to the Arctic Ocean.
Hudson Straits connect Hudson Bay with the Atlantic.
Baffin's Bay is a large inland sea between the N.E. shores of North America and the W. coast of Greenland, opening into the Atlantic by Davis' Strait, and into the Polar Sea by Lancaster Sound, etc.
Cape Sable is the southernmost point of Nova Scotia.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Who was Stephen? Who disputed the throne with him, and upon what grounds? Which do you consider to have had the better right to it?

Stephen was the son of Adela, a daughter of William the Conqueror, and hence the nephew of Henry I.
On Henry's death he usurped the crown, in defiance of an oath of fealty which he had sworn to Maud, the daughter of Henry I. She, on her return to England, after the death of her husband the Emperor Henry V., had been declared by her father heir to all his territories. Maud, then, had undoubtedly the better right to the crown.

2. Who was Richard I.? How came he to be so long absent from England, and how was the country governed during the king's absence?

Richard I., surnamed Cœur de Lion, was son and successor to Henry II. Shortly after the beginning of his reign he joined the Third Crusade, and along with the French king he set out for the Holy Land. The crusade kept him long absent from England, and during his absence the country was governed, first by the Chancellor, William of Longchamp, Bishop of Ely. He being removed was succeeded by Walter, Archbishop of Rouen. The King's brother John, who was mainly the cause of the Chancellor's removal, was declared Regent and heir to the crown. But the Archbishop and the Queen-mother mistrusting John prevented him from getting any real power. He continued to plot against his brother till Richard returned, when he was merely deprived of his lands and castles.

3. Name the locality nearest to your home which is famous for a battle fought before 1486. Describe the parties to that contest and its issue.

In 1485 Richard III., the last of the Plantagenets, was defeated and killed at Bosworth (Leicestershire) by Henry (Tudor) VII., which put an end to the civil wars between the Houses of York and Lancaster.

Composition.

Write full notes of a lesson on *The Oak*.

ARTICLES TO BE SEEN.—*Oak-leaf—oak-bark—piece of trunk—acorn—untanned leather—tanned leather—picture of tree, for children who cannot see the real thing.*

DESCRIPTION.—Noble object in a landscape—king of trees—long-lived—of great size—stands the storm—roots firm in the ground, and go a great depth—grows naturally in England—two kinds—one less firm and durable—the other has wood tough, hard, durable, no insect can pierce it—age known by counting the rings in trunk (*explain why*)—gall nuts found on leaves—oak tree best cut when it is over seventy or eighty years of age—fruit called acorns.

WHERE FOUND.—Grown in England, in forests belonging to the Crown—common in Spain, France, Portugal, Russia, Norway, Sweden, Scotland, Canada, India, etc. The English forests are—New Forest, Epping, Dean, and Sherwood.

USES.—Used wherever strength and durability are required—especially for ships—for furniture, carvings in churches, for roofs—all old buildings have oak roofs. *Oak-sawdust* used as one of the chief ingredients in dyeing the different shades of brown and drab colour. *Oak-bark* employed for tanning leather, for fuel, and manure. *Acorns* used for feeding pigs; formerly eaten by the peasantry of this country, and still eaten in Spain and Asia Minor. *Gall-nuts* used in dyeing black.

HISTORICAL NOTES.—Venerated by the Druids—William Rufus met his death by an arrow glancing from an oak—Charles II. concealed himself in an oak at Boscobel.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline.*

Write, in small letters, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If two straight lines cut one another, the vertical, or opposite angles shall be equal.

Prop. 15, Bk. I.

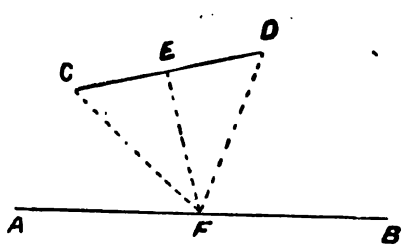
2. At a given point in a given straight line, to make a rectilineal angle equal to a given rectilineal angle.

Prop. 23, Bk. I.

3. Find a point in a given straight line such that its distances from two given points may be equal.

Let AB be the given straight line and C, D, the two given points. Join CD and bisect CD in E. From E draw EF perpendicular to CD and produce it to meet AB in F. F is the point required.

Join CF, DF.



Because CE=ED, and EF is common to the two triangles CEF, DEF, and the angles at E are right angles, then by Prop. 4, Bk. I. CF=DF, that is, the point F is equidistant from C and D.

This problem is impossible when the line joining the two points is perpendicular to the given line.

Any point in the given line will fulfil the conditions of the problem, when the given points are perpendicularly equidistant from the given line either on the same, or on opposite sides of it.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. If a grocer buys cheese at £4 13s. 4d. per cwt., how must he sell it per lb. to gain 15 per cent. on his outlay?

£4 13s. 4d. ÷ 112 = 10d. the price of 1 lb.
100 : 115 :: 10d. : 11½d. Ans.

2. If by selling tea at 3s. 6d. per lb. a grocer gains 12 per cent., how much per cent. would he gain or lose by selling it at 3s. per lb.?

42d. : 36d. :: 112 : 100 + or −

$$\frac{112 \times 36}{42} = 96$$

That is, he only gets 96 parts out of the hundred.
∴ he loses 4 p.c. Ans.

3. A man derives an income of £108 by investing £3595 10s. in the 3 per cents. What is the price of stock?

£108 : £3 :: £3595 10s. : price of stock.

$$\frac{£3595{\cdot}5 \times 3}{108} = 99\tfrac{7}{8}.$$ Ans.

4. A invests £6000 in one railway stock at 108, paying a dividend of 4 per cent.; and B invests £5000 in another railway stock at 75, paying a dividend of 2¾ per cent. What is the difference in the annual income derived?

	£	s.	d.	
£6000 × 4/108 =	222	4	5½	A's. income.
£5000 × 2¾/75 =	183	6	8	B's. ,,
diff. of income =	38	17	9½	Ans.

5. Divide £1746 amongst A, B, and C, so that B may have 50 per cent. more than A, and C 33·3 per cent. more than B.

Let A have 2 parts,
then B has 3 ,,
and C ,, 4 ,,
Total 9 ,,

Hence A's share = 2/9 of 1746 or £388. Ans.
,, B's ,, = 1/3 ,, ,, £582. Ans.
,, C's ,, = 4/9 ,, ,, £776. Ans.

FEMALES.

1. Find the value of ·007 × 700 × 760·3 × ·00416 × 100,000.

·007 × 700 = 4·9
4·9 × 760·3 = 3725·47
3725·47 × ·00416 = 15·4979552
15·4979552 × 100000 = 1549795·52. Ans.

2. Find the quotient of ·7575 by 16¾.

·7575 ÷ 16¾ = ·7575 ÷ 67/4

$$= \frac{2{\cdot}2725}{50} = {\cdot}04545.$$ Ans.

3. Find the value of ·972916 of £1.

£·972916 = 19s. 5½d. Ans.

20
19·4583s.
12
5·5d.

4. Find the value of the following expression:—·68125 of £1 + ·375 of 13s. 4d. + ·605 of £3 2s. 6d.

	£	s.	d.
£·68125	= 0	13	7½
·375 of 13s. 4d.	= 0	5	0
·605 of £3 2s. 6d.	= 1	17	9½
	2	16	5½ Ans.

Grammar.

1. 'And now *farewell*. I am *going* a long *way*
To the island valley of Avilion;
Where falls not *hail*, or rain, or *any* snow,
Nor ever wind blows loudly, but it lies
Deep-meadowed, happy, fair with orchard lawns,
Where I will *heal me* of my grievous *wound*.'
TENNYSON.

(*a*) Give an example from the above of a simple predicate, of a predicate with its complement, and of a predicate with its extension.

(*b*) Parse the words in italics.

(*c*) 'An adjective sentence is sometimes introduced by a relative adverb;' give an example of this from the above.

(*a*) 'Falls' is a simple predicate; 'of my grievous wound' is the complement of the predicate 'heal'; 'ever' and 'loudly' are extensions of the predicate 'blows.'

(*b*) '*farewell*'—(=may you fare well) an expression of courtesy now used interjectionally, equivalent to a noun governed by such a verb as 'bid.'
going—incomplete part. of *go*, *went*, *gone*, forming part of the progress. form of the verb 'go.'
way—abstr. noun, neut., sing., obj. of distance.
where—subord. abverb. conj., modif. 'falls.'
hail—com. noun, neut., sing., nom., subj. of 'falls.'
any—indef. adj., qual. 'snow.'
deep-meadowed—predic. adj., qual. 'it.'
heal—reg. trans. verb, infin., pres., indef., gov. by 'will.'
me—(=myself) emph. pron., 1st pers., sing., mas. (or fem.), obj., gov. by 'heal.'
wound—com. noun, neut., sing., obj., gov. by 'of.'

(*c*) 'Where falls not hail,' etc., is an adj. sent., qual. 'Avilion.'

2. Point out the Latin preposition in each of the following words, and give the meaning of each preposition, and of the word with which it is compounded—*superfluous*, *extra-mural*, *percolate*, *cisatlantic*.

superfluous is compounded of 'super' above, and 'fluere' to flow.
xtra-mural ,, ,, 'extra' beyond, and 'murus' a wall.
percolate ,, ,, 'per' through, and 'colare' to filter.
cisatlantic ,, ,, 'cis' on this side, and 'Atlantic' the Atlantic Ocean.

Geography.

Answer either Q. 2 or Q. 3; not both.

1. Draw a map of Lower Egypt; showing the positions of Alexandria, Cairo, Damietta, Rosetta, Port Said, Ismailia, Suez, and the two mouths of the Nile. Insert the lines of latitude and longitude.

2. Give notes of a lesson on Japan and the Japanese.

Lesson to be given before a map of Asia.

I. JAPAN.—(1) *Position.*—Japan is situated in the Pacific Ocean, N.E. of the great Chinese Empire; occupies the space between the southern extremity of the Peninsula of Kamtchatka and the Peninsula of Corea.

(2) *Parts.*—It consists of a number of islands, the principal being Yesso, Niphon, Sikok, and Kiu-Siu.

(3) *Extent.*—Total area about 155,000 square miles.

(4) *Surface.*—Bold and picturesque; traversed by chains of mountains, running north and south; some of the summits are active volcanoes; rivers are short and rapid; soil fertile; coast abounds with magnificent harbours.

(5) *Climate.*—Varies with the latitude; in north it resembles that of England; in southern islands it is as warm as that of France or Italy.

(6) *Productions.*—Flowers and fruits abundant and rich; birds numerous; seas abound with fish; country rich in minerals, chief one being copper, but gold, silver, iron, and sulphur also found; coal is abundant. Of native trees, the most remarkable are the *varnish-tree*, whose juice is used in lacquering furniture; the *camphor-tree*, the *paper-mulberry*, and the vegetable *wax-tree*. Domestic animals are scarce. Rice, wheat, and other cereals; cotton and tobacco plants; the tea-shrub and potato are diligently cultivated.

(7) *Trade and Commerce.*—Internal trade very considerable, and there are regulations in force to protect and encourage native industry. Railways and telegraphs have been introduced, and lighthouses erected round the coasts. Foreign commerce much encouraged, the chief exports being copper, camphor, tea, silk, lacquered goods, porcelain; the chief imports, sugar, coffee, spices, lead, tin, iron ware, and cotton goods.

(8) *Chief Towns.*—Yeddo, Yokohama, Kioto, Osaka, Nangasaki, Hakodadi, and Matsumai.

II. JAPANESE.—Belong to the Mongolian family of nations; differ frome the Chinese in language and character; they are persevering, courageous, and frank; clean, sober, and contented; open to the influences of Western civilization, readily adopting the manners and customs of Europe.

Their food consists of rice, vegetables, and fish, and they abstain religiously from animal food; tea is the universal drink.

European artizans have been employed to instruct the natives: numbers of the nobility have been sent to Europe to improve their education; there are common schools, and colleges with European professors.

The Japanese are skilful in making cotton and silk fabrics, in lacquering or 'japanning'; they display great ingenuity in working metals and cabinet work; in adapting paper to various uses—this material, made from the bark of the mulberry-tree, is wrought into cigar-cases, trunks, saddles, towels, etc.

3. Say what you know about Trichinopoly, the Neilgherry Hills, Seringapatam, Hyderabad, the Godavery, the Krishna, and the Nerbudda.

Trichinopoly is a city and fortress of British India, in the Presidency of Madras, on the river Cauvery. It has a large pagoda, and is celebrated for the manufacture of chains and jewellery.

Neilgherry Hills are a cluster of hills formed by the union of the Eastern and Western Ghauts in the south of the plateau of the Deccan.

Seringapatam is a strong town of Mysore in British India, formerly the capital of the province under Hyder Ali and Tippoo Sahib. It stands on an island formed by the Cauvery, and was taken by the British in 1799.

Hyderabad.—There are two cities of this name in India; one in the Bombay Presidency, near the Indus, and noted for the manufacture of lacquered snuff-boxes; another, capital of Nizam's dominions, in a barren district. It is distinctly a Mussulman city, and the principal mosque is a model of the Kaaba, at Mecca.

The Godavery rises near the northern extremity of the Western Ghauts. Its chief feeder is the Pranheta. It traverses nearly the whole breadth of the Indian peninsula, and falls by several mouths into the Bay of Bengal, after flowing 900 miles. There are few important towns on this river, but the forests along its banks supply excellent timber.

The Kistna or *Krishna* rises in the Western Ghauts, flows south and then eastward, and empties itself into the Bay of Bengal, by a delta which almost unites with that of the Godavery.

The Nerbudda, 800 miles long, rises in the British district of Ramgurh, flows west between the Vindhya and Sautpoora Mountains. Its current is obstructed by rocks and shallows, and its banks clothed with dense jungle. It has fewer windings than most Indian rivers.

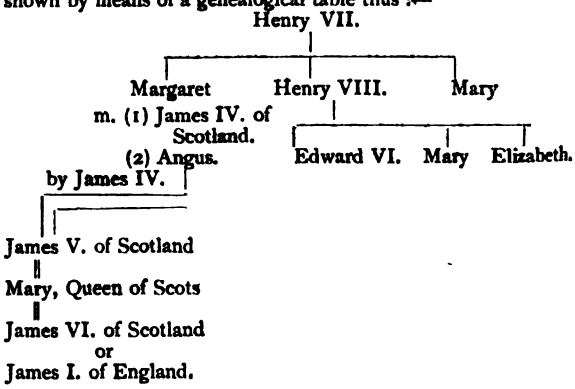
SECOND PAPER.

Two hours and a-half allowed.

History.

1. Show the connection of James I. with his predecessors on the English throne, and explain how the great parties here came to assent to his accession.

The connection of James I. with his predecessors is best shown by means of a genealogical table thus:—



His predecessors on the English throne were *Elizabeth*, *Mary*, *Edward VI.*, children of his great-grand-uncle, *Henry VIII.*

The three great parties assented to his accession, because they all looked for support from him; the English Puritans hoped for support because their views strongly resembled the Presbyterians of Scotland; the Roman Catholics relied upon the mildness James had always shown towards the Scotch Roman Catholics; the Episcopalians rejoiced in the accession of a sovereign who had warmly embraced their cause.

2. Give dates and localities of any battles fought since 1486 in the county where you live, or in an adjoining county. Describe the parties engaged in one of them with its result.

The Battle of Stoke was fought in 1487, near Newark in Nottinghamshire, when Lambert Simnel was defeated by the forces of Henry VII.

The Battle of Flodden was fought in 1513, near Wooler, in Northumberland, when James IV. of Scotland was defeated and slain by the troops of Henry VIII., under the Earl of Surrey.

A battle was fought at Solway Moss, in Cumberland, on the Scottish Border, 1542, when the troops of James V. were ignominiously routed by the troops of Henry VIII.

The following battles may be noted: *Edgehill* (in Warwickshire, near the Oxford border, 1642); *Chalgrove* (Oxfordshire, near Oxford, 1643); *Newbury* (Berkshire, 1643-44); *Marston Moor* (near York, 1644); *Naseby* (near Northampton, 1645); *Preston* (in Lancashire, 1648); *Sedgemoor* (in Somerset, near Bridgewater, 1685).

3. When was the Legislative Union of Great Britain and Ireland effected? Describe events which led to it.

The Legislative Union of Great Britain and Ireland was effected on 1st January, 1801.

During the war of the French Revolution the United Irishmen entered into treasonable correspondence with France, from which more than one expedition was sent to their aid. Of these the most formidable, under General Hoche, was scattered by a tempest in 1796; another in 1798 made its way into Longford, where it was forced to surrender, while the United Irishmen were routed at Vinegar Hill, in Wexford. Of the chiefs of the conspiracy, Lord Edward Fitzgerald died of the wounds received while defending himself from arrest, and Wolfe Tone killed himself. After the insurrection had been quelled, the Irish Parliament, which had been independent of the British House since 1782, ceased to exist January 1st, 1801, and thenceforth Ireland sent her representatives to Westminster.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline*.

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

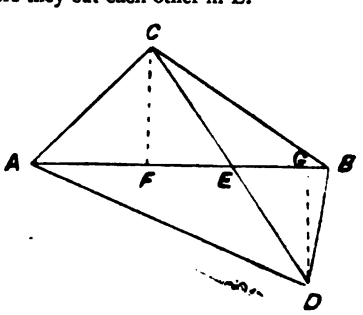
Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If a quadrilateral figure be bisected by one diagonal, the second diagonal is bisected by the first.

Let the quadrilateral ACBD be bisected by the diagonal AB, (that is, the triangle ACB or ADB is the half the figure,) then if the other diagonal CD be drawn, it will be bisected by AB, namely, where they cut each other in E.



Since the triangles ACB, ADB are equal, and stand on opposite sides of the same base, it is evident that their altitudes (that is, the perpendicular from the vertex upon the base) must be equal, for if on the same side of the base they would be between the same parallels. Therefore, the perps. CF, DG, are equal, and the angles at F and G are equal, as also the vertical angles at E.

Wherefore, by 26th prop., Bk. I., the triangles CFE, DGE, are equal in every respect, and therefore CE = ED.

Q. E. D.

2. Any two angles of a triangle are together less than two right angles.

Prop. 17, Bk. I.

3. If a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles, and the three interior angles of every triangle are together equal to two right angles.

Prop. 32, Bk. I.

Algebra.

1. Simplify $(a+b)^2-(b+a)(a-b)-\{a(2b-2)-(b^2-2a)\}$

$$\begin{aligned}(a+b)^2 &= a^2+2ab+b^2\\ -(b+a)(a-b) &= -a^2+b^2\\ -\{a(2b-2)-(b^2-2a)\} &= 2a-2ab+b^2-2a\end{aligned}$$

by addition we get $2b$ Ans.

2. Find the G. C. M. of $x^2-7x+10$ and $4x(x^2+10)-25x-62$

$x^2-7x+10=(x-5)(x-2)$

$4x(x^2+10)-25x-62=4x^3+15x-62=(x-2)(4x^2+8x-31)$

$\therefore$ $x-2$ is the G. C. M. Ans.

3. Solve the equation:—

$$\frac{2x-6}{3x-8}=\frac{2x-5}{3x-7}$$

Clearing of fractions $6x^2-32x+42=6x^2-31x+40$

collecting $x=2$. Ans.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after, 1st May,* **1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this paper.

Arithmetic.

MALES.

1. A man invests £4875 in the 3 per cents. at 97½; he afterwards sells out at 99, and reinvests the money in railway shares at 110 paying a dividend of 4 per cent. Find the increase in his income.

(*a*) £97½ : £4875 :: £3 : 1st income.

$$\frac{£3\times 4875\times 2}{195}=£150$$

(*b*) £97½ : £4875 :: £99 : Money received by selling stock.

$$\frac{£99\times 4875\times 2}{185}=£4950$$

(*c*) £110 : £4950 :: £4 : 2nd income.

$$\frac{£4\times 4950}{110}=£180$$

Increase in income = £180 − £150, or £30. Ans.

2. Find the present value of a bill for £2287 10s. due 5 months hence, interest being at 4 per cent. per annum.

Interest on £100 for 5 mos. at 4 p. c. = £1⅔.

Amount of £100 for 5 mos. at 4 p. c. = £101⅔.

£101⅔ : £100 :: £2287 10s. : pres. val.

$$\frac{£2287\frac{1}{2}\times 300}{305}=\frac{£1372500}{610}=£2250.$$ Ans.

3. First find the value of ·2142857 of 3 guineas + 1·375 of £2 − ·0625 of a crown + 4·16 of 1d. ; and reduce the result to the decimal of £5.

(*a*) ·2142857 of 3 guin. = 13·5s. = 162
1·375 of 40s. = 55s. = 660
4·16d. of 1d. = 4$\frac{1}{7}$
Total = 826$\frac{1}{7}$
deduct ·0625 of 60d. = 3$\frac{3}{4}$
Result = 822$\frac{5}{28}$

(*b*) $\frac{822\frac{5}{28}\text{d.}}{£5} = \frac{822\frac{5}{28}\text{d.}}{1200\text{d.}} = \frac{23045}{33600} = \underline{\cdot 6853472}$. Ans.

4. The capital of a railway company is £5,000,000 ; the gross earnings in a year are £500,000, and the expenses are 55 per cent. of the earnings. What dividend per cent. can the company pay on the capital?

$\frac{45}{100}$ of £500,000 = £225,000 sum to be divided.
£5,000,000 : 100 :: £225,000 : dividend per cent.
$\frac{£225000 \times 100}{5{,}000{,}000} = \underline{4\frac{1}{2} \text{ per cent.}}$ Ans.

5. A man mixes 36 gals. of whiskey at 15s. a gal., with 36 gals. at 13s. 6d. a gal., and adds 9 gals. of water. If he sells the mixture at the rate of 19s. a gallon, what per cent. does he gain on his outlay?

	s.
36 galls. at 15s.	= 540
36 ,, ,, 13½s.	= 486
9 ,, water	
81 galls. cost	1026
81 ,, sold at 19s. each	= 1539
gain	= 513

∴ 1026 : 513 :: 100 : gain per cent.
$\frac{100 \times 513}{1026} = \underline{50}$. Ans.

FEMALES.

1. Find the amount of £417 7s. 9d. for 1 year 10 months at 4$\frac{4}{5}$ per cent.

Interest = £417 7s. 9d. × $\frac{22}{12}$ × $\frac{4\frac{4}{5}}{100}$
= 417·3875 × $\frac{11}{250}$
77
29217125
29217125
80)321387875
12)4017354687 5
£33·47795572916
20
9·559114583s.
12
6·709375d. = 6$\frac{12}{32}$.
∴ Amount = £417 7s. 9d. + £33 9s. 6$\frac{12}{32}$d.
= £450 17s. 3$\frac{12}{32}$d. Ans.

2. If tea be bought at 3s. 6d. per lb., and be sold at 3s. 10½d. per lb., find the gain per cent.

42d. : 100d. :: 4½d. : gain per cent.
$\frac{4\frac{1}{2}\text{d.} \times 100}{42} = \underline{10\frac{5}{7} \text{ p. c.}}$ Ans.

3. A hare pursued by a greyhound was 130 yards before him at starting; whilst the hare ran 5 yards, the dog ran 7 yards; how far had the hare gone when she was caught by the dog?

The dog gains 2 yards every time the hare goes 5 yards, how far will the hare go before the dog gains 130 yards?
2 yds. : 130 yds. :: 5 yds. : distance required.
$\frac{5 \text{ yds} \times 130}{2} = \underline{325 \text{ yds.}}$ Ans.

4. If 20 men can do a piece of work in 12 days, find the number of men who could do another piece of work 3 times as great in ⅓th of the time.

1 : 5 } :: 20 : men required.
1 : 3 }
20 men × 5 × 3 = 300 men. Ans.

Grammar.

1. '*How* many men, in the common concerns of life, lend sums of money which they are not *able* to spare, *are bound* for persons whom they have little friendship *for*, give recommendatory characters of men *whom* they are not acquainted with, bestow places on those whom they do not esteem, *live* in such a manner as *themselves* do not approve, and *all this* merely because they have not the confidence to resist solicitation, importunity, or example!' ADDISON. *Essay on False Modesty.*

(*a*) Show from the above that an infinitive may be the complement of a verb.
(*b*) Analyse from *How many men* to *spare*.
(*c*) Parse the words in italics.
(*d*) To what period of the English language does the above belong? Notice any difference you may observe in it, compared with the style of the present day.

(*a*) The infinitive 'to spare' is the complement of 'are not able.'
The infinitive '(to) esteem' is the complement of 'do.'
,, 'approve' ,, 'do not.'

(*b*) (1) 'How many men, in the common concerns of life, lend sums of money.' (Principal sent.)

(2) 'Which they are not able to spare.' Subord. adj. sent. qual. 'sums of money.'

ANALYSIS.

	1.	2.
Simple subject	'*men*'	'*they*'
Enlargement of subject	'*how many*'	
Predicate	'lend'	'*are not able to spare*'
Object	'*sums*'	'*which*' (obj. of 'to spare')
Enlargt. of object	'*of money*'	
Extension of predicate	'*in the common concerns of life.*'	

(*c*) *How*—adv. of degree mod. 'many.'
able—predic. adj. qual. 'they.'
are—, *bound*— irreg. trans. verb, *bind*, *bound*, *bound*, pass, voice, indic., pres., indef. 3rd pers. plur., agr. with subj. 'men.'
for—prep. (used after its case), gov. obj. case 'whom.'
whom—simple rel. pron. referring to 'men,' 3rd pers. plur., mas., obj. gov. by 'with,' which follows its case.
live—reg. intrans. verb, indic., pres., indef., 3rd pers. plur. agr. with ('men').
themselves—(= they) compound pers. pron., 3rd pers. plur., mas., nom., subj. of 'do.'
all—indef. adj. pron. qual. 'this.'
this—demonstr. adj. pron., sing., neut., nom. to such a verb as 'is done,' understood.

(*d*) The passage belongs to the period of Modern English of the age of Queen Anne.
The following differences may be noted: the preposition is used after the relative 'whom;' 'recommendatory' is not usual now; 'themselves' cannot be properly used without 'they;' instead of using 'men' to play the part of subject to so many verbs it is customary now-a-days to break up such a passage into two or three sentences.

2. Give the meaning of the following words:—*Ethics*, *astronomy*, *eucharist*, *monastery*. State to which element in our language they belong and account for their introduction into our language.

Ethics means 'a system of morality.'
Astronomy ,, 'the science of the stars.'
Eucharist ,, 'the Lord's supper' (a thanksgiving).
Monastery ,, 'a house for monks, convent.'

These words belong to the Greek element of our language; 'eucharist' and 'monastery' came to us in Latin forms during what has been called the Latin of the second period, that is, the Latin brought through intercourse with the Church of Rome, between the coming over of St. Augustine and the Norman Conquest.
'Ethics' and 'Astronomy' were introduced after the revival of learning to supply the need for expressive terms in science and philosophy.

Geography.

1. Give full notes of a lesson on the Gulf of Mexico, and illustrate by a map. Insert the lines of latitude and longitude.

POSITION AND BOUNDARIES.—A large mediterranean sea of North America, communicating by the Florida Channel with the Atlantic, and by the Channel of Yucatan with the Caribbean Sea, and on the other sides enclosed by the United States, Mexico, and Yucatan. The eastern side is bounded by the Antilles.

EXTENT AND CHARACTER.—Extends from east to west, over 1,000 miles, and its greatest breadth is nearly as much. Its shores are low in general, and skirted with flat, sandy islands. Its waters are distinguished by their high temperature, being generally eight or ten degrees above that of the neighbouring ocean.

GULF STREAM.—The distinguishing feature of the Gulf of Mexico is the Gulf Stream, so called from passing through this Gulf. This stream is the local name of a section of the equatorial current of the Atlantic, which current passes through the Windward Islands, across the Caribbean Sea, into the Gulf, which, with only two outlets and hemmed in by mountains, is exposed to the full heat of a tropical sun. As the stream sweeps round the Gulf it becomes very hot, and is swollen by the waters of the Mississippi, till at length it forces its way out into the Atlantic between Florida and Cuba in a stream of from thirty to forty miles wide and 600 or 700 ft. deep, and at a speed of about eighty miles a day.

RIVERS AND TOWNS OF THE MEXICAN GULF.—Mississippi, Colorado, Rio Grande del Norte, Santander, Tabasco. Galveston, Mobile, New Orleans, are the chief ports.

2. What is a river-basin? Illustrate your answer by reference to the basin of the Amazon.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it, with all their tributaries up to the water-parting of each.

The Amazon is formed by the junction of the Maranon and Ucayali. The Maranon rises in a small lake on the plateau of Pasco, and the Ucayali is its head-stream, rising in the table-land of Cuzco. From the junction of these two streams the Amazon flows easterly for 3,000 miles, before reaching the Atlantic, into which it empties itself by a large estuary which contains numerous islands, and is 180 miles wide at its mouth.

More than twenty feeders of this mighty river are at least 1,000 miles in length, and these flow mainly from the south. Among them may be noted the Purus, Madeira, Tapajos, Xingu, Tocantins. The Madeira is the largest tributary, and exceeds 2,000 miles in length.

Among the northern tributaries are the Napo, Japura, and Rio Negro; the last being 1,400 miles long.

The basin of the Amazon embraces an area of two and a-half million square miles, and is bounded by the Andes in the west, the mountains of Guiana in the north, and the mountains and high-lands of Brazil in the south.

SECOND PAPER.

History.

Two hours and a half allowed.

1. What periods of our history have been remarkable for contests with France? To what in general would you attribute those contests?

The periods most remarkable for contests with France were during the reigns of Edward III. and Henry V. The former laid claim to the French crown by right of his mother, and to support his claim the battles of Crecy (1346) and Poictiers (1356) were fought. The latter claimed the fulfilment of the Treaty of Bretigny, which had been concluded with Edward III. This being refused, Henry V. invaded France, and by the battle of Agincourt (1415) completely routed the French. Five years after was framed the Treaty of Troyes, by which it was agreed that Henry should become King of France on the death of Charles.

Hence we conclude that the general cause of these wars was the desire of the British kings to get possession of the French crown. The title 'King of France' was till lately claimed by our monarchs.

2. What was the condition of Parliament during September, 1882? What is its condition now, and what do you expect to be the next change?

In September, 1882, Parliament was *adjourned*, in the end of October it was *in Session*, and the change expected was its *prorogation*.

3. Give dates and brief particulars of any wars in which this country has been engaged during the present reign in Europe, Asia, and Africa.

In 1840 England took the part of the Sultan of Turkey against the Pasha of Egypt, and Acre was bombarded by Stopford and Napier.

In 1840 a war arose with China about the opium trade, and Hong-Kong was ceded to Britain. In 1856, and again in 1860, fresh quarrels arose, and the English and French entered Pekin.

In 1838 a war begun in Afghanistan is memorable for the disasters which befell the British troops in occupation of Cabul. Being forced to retreat by a rising of the natives, they were cut off almost to a man, one officer alone escaping to Jellalabad.

In 1843 Sir Charles Napier conquered Sind.

In 1845 and again in 1848, wars with the Sikhs of the Punjaub ended by the victory of Goojerat, 1849.

In 1850 British Kaffraria was conquered from the Kaffirs.

In 1867 Sir Robert Napier conducted the Abyssinian Expedition against King Theodore to rescue certain British subjects and other Europeans.

In 1873 Sir Garnet Wolseley chastised the Ashantees.

In 1879 Zululand was conquered by the British.

In 1881 the Boers, who had risen in the end of 1880, were granted self-government under the suzerainty of the British.

In 1882 the Egyptians, under Arabi, rebelled against the Khedive. The rebels were scattered by Sir G. Wolseley at Tel-el-Kebir.

The only war in Europe during the reign was the Crimean war, in 1854-55, undertaken in conjunction with the French to assist the Turks against Russia. During the war occurred the battles of the Alma, Inkerman, and Balaclava. It was ended by the taking of Sebastopol, 1855.

In 1857 occurred the outbreak of the Indian Mutiny, which was completely stamped out by the taking of Lucknow, in the beginning of 1858.

By the murder of the British resident at Cabool, General Roberts made a triumphant march, punished the Afghans, and occupied the city. However, he was eventually ordered by the Government at home to withdraw, 1879.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline*.

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write a short essay on *Fables and their uses.* (Illustrate the subject by giving any fable you can remember.)

FABLES AND THEIR USES.

In a general sense fables mean fictitious narratives, but they also mean more particularly a species of composition, consisting of short fictitious tales, written for the purpose of teaching some moral truth or precept. The fable is sometimes divided into two kinds, the *fable proper* and *the parable.* The parable narrates some incident which, although it may not have happened exactly as the narrator supposes, yet could have happened, there being nothing impossible or improbable in it. The fable proper, on the other hand, relates facts which are evidently untrue, and could not have happened; such as animals or even inanimate things speaking, but which serve as comparisons for the actions of men. The fable embodies a moral in a special case; this is invested with reality, and narrated as a story, which suggests the moral at once. Thus the well-known story of 'The Man and the Bundle of Sticks' embodies a moral truth, namely, the power of union.

Many of the fables proper, or Apologues as they are called, turn upon the actions and characteristics of animals. This practice has evidently risen out of the circumstance that the animals chosen have a certain fixed character; as the cunning of the fox, the strength of the lion, the meekness of the lamb.

When a fable is lengthened into details, so as to form long and sustained comparison, it is called an Allegory.

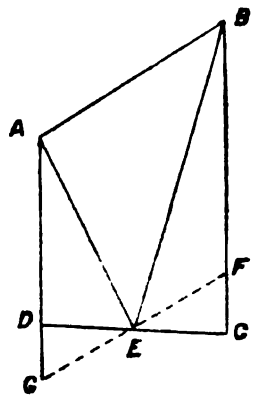
Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. A B C D is a trapezoid, B C being parallel to A D. If E be the middle point of D C, the triangle A E B is half the trapezoid.

Through E draw G E F parallel to A B, and produce to meet the parallel sides of the trapezoid in F and G.



Then (I. 26) the triangles D E G, E F C are equal, and thus the trapezoid is equal to the parallelogam A G F B.

Now (I. 41) the triangle A E B is half of the parallelogram A G F B, and therefore equal to half the trapezoid. Q. E. D.

2. To draw a straight line through a given point parallel to a given straight line.

Prop. 31, Bk. I.

3. If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the parts.

Prop. 4, Bk. II.

Algebra.

1. Find the value of $\frac{b}{a+b}+\frac{b}{a-b}-\frac{b^2}{a^2-b^2}$ when $4b=3a$.

L. C. M. of denrs. $=a^2-b^2$

$$\therefore \frac{ab-b^2+ab+b^2-b^2}{a^2-b^2}$$

$$=\frac{2ab-b^2}{a^2-b^2}$$

Substituting $\frac{3}{4}a$ for $b=\left(2a\times\frac{3a}{4}-\frac{9a^2}{16}\right)\div\left(a^2-\frac{9a^2}{16}\right)$

$$=\left(\frac{3a^2}{2}\text{ or }\frac{24a^2}{16}-\frac{9a^2}{16}\right)\div\left(\frac{16a^2-9a^2}{16}\right)$$

$$=\frac{15a^2}{16}\times\frac{16}{7a^2}=2\tfrac{1}{7}.\quad\text{Ans.}$$

2. Solve the equations :—

(1) $\frac{3x}{4}-\frac{2y}{3}=1=\frac{7x}{18}+\frac{5y}{36}$

(2) $\frac{68x}{7}-\frac{7}{x}=8x+11$

(1) Clearing of fractions $9x-8y=12$ or $45x-40y=60$

$14x+5y=36$ or $112x+40y=288$

By adding $157x=348$

$x=2\frac{34}{157}$.

$y=\frac{144}{157}$.

(2) Clearing of fractions $68x^2-49=56x^2+77x$

Transposing and collecting $12x^2-77x-49=0$

Factorizing $(12x+7x)(x-7)=0$

Hence $x=7$

Or $x=-\frac{7}{12}$. Ans.

3. Find two consecutive numbers, such that the half and the fifth of the first taken together shall be equal to the third and the fourth of the second.

Let x = the one, then $x+1$ = the other

$$\therefore \frac{x}{2}+\frac{x}{5}=\frac{x+1}{3}+\frac{x+1}{4}$$

clearing of fractions $30x+12x=20x+20+15x+15$

transposing $42x-35x=35$

$7x=35$

$x=5$ first No. Ans.

and 6 second No. Ans.

Mensuration.

MALES.

Find the side of an isosceles right-angled triangle whose area is the same as that of the triangle with sides 10, 11, 12.

$$\text{Half sum of sides}=\frac{10+11+12}{2}=16\cdot5$$

$$\therefore \text{Area of triangle}=\sqrt{16\cdot5\times6\cdot5\times5\cdot5\times4\cdot5}$$

$$=\sqrt{2654\cdot4375}$$

$$=51\cdot52.$$

Now in an isosceles right-angled triangle the base = perpendicular; and as the area of such a triangle will equal *half the square of base or perpendicular*,

$$\therefore \frac{\text{Base}^2}{2}=\text{area}=51\cdot52$$

$$\text{Base}^2=103\cdot04$$

$$\text{Base}=\sqrt{103\cdot04}$$

$$=10\cdot15.\quad\text{Ans.}$$

—o—

[*All changes in this Syllabus for the year* 1883 *are printed in italics.*]

Syllabus for Male Candidates.

DECEMBER, 1883.

Education Department.

The Examination for Certificates will commence on Monday, the 10th of December, 1883, at 3 p.m.

N.B.—Acting Teachers attending the examination may, at their option, take the papers of the first or second Year, *subject to the provisions of the following Articles of the Code of 1882* :—

Article 66.—Candidates who at the examination of December, 1883, or any subsequent examination, shall pass successfully in the subjects for the first years' students will receive certificates of the third class.

Article 67.—Certificates of the third class do not entitle their holders to have the superintendence of pupil-teachers.

Article 68.—Certificates of the third class can be raised to a higher class only by a subsequent examination in the subjects for second years' students. A teacher cannot be re-examined for this purpose more than once in every two years.

Reading* and Repetition from Memory.

First Year.

To read with a distinct utterance, due attention to the punctuation, and just expression. Each Student must have learned at least 300 lines of poetry from the work selected under Grammar (section 2), and will be called upon to repeat some part at the Annual Inspection of the Training College.

Second Year.

Candidates will be expected to show improvement in the higher qualities of Reading, such as expression, modulation of voice, and the correct delivery of long or involved sentences. Each Student must have learned at least 300 lines of poetry or 200 lines of prose from one of the works named under Grammar, and will be called upon to repeat some part at the Annual Inspection of the Training College.

Penmanship.

First Year.

1. To write a specimen of the penmanship used in setting copies of text hand and small hand.

2. To write a passage from Dictation.

3. The general character of the writing in the Examination Papers will be considered in deciding upon the proficiency of Candidates in the subject.

* The Students of the *first* year will be expected to read a passage from Goldsmith's *Traveller*, Milton's *Comus*, or Lamb's *Tales from Shakespeare*; the Students of the *second* year from Shakespeare's *Macbeth* and *Tempest*, *or* from a newspaper. These authors must not be studied in class, but must be left to the private reading of the Students.

Second Year.

As in First Year, but defects more severely visited with loss of marks.

NOTE.—Writing, as taught in schools, is apt to be too small and indistinct. Pupils should be taught to write a firm, round, legible hand.

School Management *

First Year.

1. The methods and principles of elementary teaching, generally, and with special reference to the development of the intelligence of children.
2. Notes of Lessons.
3. The form of school registers, the mode of keeping them, and of making returns from them.

Second Year. †

1. To teach a class in the presence of Her Majesty's Inspector.
2. To answer questions on the following subjects :—
   (*a.*) The different methods of organizing an elementary school.
   (*b.*) The form of school registers, the mode of keeping them, and of making returns from them.
   (*c.*) The ventilation and drainage of School Premises.
3. The training of the senses and of the memory; the processes of reasoning; the order in which the faculties of children are developed; the formation of habits and of character;—all considered in their application to the methods of teaching and of moral discipline.

Grammar and Composition.

First Year.

1. The elements of Grammar.
2. To parse words selected from passages in Byron's *Childe Harold's Pilgrimage, Canto III., stanzas 1—60.*
3. To analyse passages from the Book selected.
4. To write plain prose upon a given subject.
5. An explanation of the meaning and words in the selected passages.

Second Year.

1. To paraphrase passages from Shakespeare's *Julius Cæsar* and Bacon's *Essays* (*38-58*).
2. To answer questions on the language, style, and subject-matter of the work chosen for paraphrase.
3. To write plain prose upon a given subject.

Geography.

First Year.

1. The elements of Geography, Mathematical and Physical.
2. To describe in words, and draw the map of, the four quarters of the globe, of each country in Europe (that of Great Britain in fuller detail), and of Hindostan, Australia, New Zealand, Canada, and the South African colonies.
3. The Political Geography of the British Empire.

Second Year.

1. The Geography, Physical, Political, and Commercial, of the British Empire.
2. Map drawing, confined within these limits.

History.

(The Papers will contain questions on the history of Scotland.)

First Year.

General outlines of British History.

Second Year.

A special period in greater detail. From the year *1760* to the accession of Queen Victoria.

Arithmetic, Algebra, and Mensuration.

First Year.

1. To work Arithmetical sums, both mentally and on paper.
2. To prove and explain the rules.

The figures should be well formed and the work methodically arranged as a good model for children to imitate.

3. To answer simple * questions, both theoretical and practical, in Algebra, and the Mensuration of plane surfaces.

Second Year.

More difficult questions,* and problems, in Algebra, and Mensuration.

Geometry.

First Year.

The first two books of Euclid, with simple deductions from the propositions *and easy geometrical problems.*

Second Year.

The first four books of Euclid, and the first fifteen propositions of the Sixth Book, with simple deductions from the propositions *and easy geometrical problems.*

Economy.

Second Year.

Elementary Questions in Political Economy. Works on this subject, published of late years for use in schools, contain matter to which these questions will have reference.

Vocal Music.

First Year.

1. Notation: the treble and bass staves, and the relation between them.
2. Time: Simple common, and simple triple.
3. The scales, major and minor; with the intervals (major and minor, perfect or other) found in both, and the chromatic intervals found in the latter.
4. Transposition from one key to another; and transcription from one variety of time to another (as from $\frac{3}{4}$ to $\frac{3}{4}$).

Second Year.

1. Notation: The alto and tenor staves, and their relations to the treble and bass.
2. Time: compound common and compound triple.
3. Classification of intervals, as perfect and imperfect, consonant and dissonant.
4. Resolution of individual dissonant intervals.
5. Rudiments of harmony: Positions of chords; progression; inversion; discords by suspension (on fundamental basses only); the discord of the dominant seventh (in its direct form only).

NOTE.—A paper on this subject is not given to any Student, about to leave the Training College, how has not passed the Musical Inspector's examination in practical skill. Acting teachers who take this paper must produce a certificate from some competent person (such as the organist of their church) that they have 'such an amount of musical skill, vocal or instrumental, as is sufficient for the purpose of teaching children to sing from notes.'

Drawing.

[*N.B.*—This exercise does not form part of the December examination. Annual examinations, in drawing only, are held at each of the Training Colleges under inspection some time in November, and at the various local drawing schools in connection with the Department of Science and Art, at times to be learned from the masters of those schools. The value of the exercises is marked, and the marks carried to each candidate's total, for a certificate under this Syllabus.]

* Passages taken from Reading Lesson Books commonly used in schools may be given in the papers on all subjects which admit of it, and candidates will be expected to show how they would explain such passages to children. Each paper may also contain questions on the method of teaching the elementary parts of the subject to which it relates.

† No Student will be examined, unless the Principal certifies that he has spent at least six weeks, or 150 hours, in the Practising and Model Schools, under proper superintendence, during his residence, and at least half that time during his second year.

*In Algebra, the Students of the first year should understand the four simple rules, involution, evolution, common measures, common multiples, algebraic fractions and surds, ratios and proportions, progressions and the solution of simple and easy quadratic equations, of one or more unknown quantities, or problems producing such. Those of the second year should, at least, add to this a knowledge of permutations and combinations, the Binomial Theorem, logarithms, interest and annuities, scales of notation, and the solution of more difficult equations or problems producing such.

In Mensuration, the Students of the first year should understand the measurement of every species of plane rectilineal figure, *and of the circle.* Those of the second year should add to this a knowledge of the measurement of cylinders, spheres, cones, and a few irregular solids.

Students of the first year who do not obtain at least 60 per cent. of the total number of marks obtainable in Algebra and Mensuration will be required to take up the same portions of those subjects in their second year.

The series of exercises prescribed in the Art Directory * of the Department of Science and Art for a Drawing Certificate of the Second Grade.

Special Subjects.

Additional marks will be given to a Candidate for success in some of the following subjects, provided that he passes for a Certificate, according to this Syllabus, without counting marks for these special subjects.

I. Languages.

1. Latin.
2. Greek.
3. French.
4. German.

Candidates may take one or two (but not more) of these languages. Students will be examined in those languages only for which a special course of instruction is provided in the Time Table of their College.

First Year.

This paper will contain grammatical questions, and easy passages † in prose for translation from and into English.

Second Year.

This paper will contain harder passages † (in poetry as well as prose) for translation from and into English prose, with questions upon the construction of particular sentences.

II. Science.

See Extracts from Minute of 17th January, 1878.
At Whitehall, the 17th day of January, 1878.

BY THE RIGHT HONOURABLE THE LORDS OF THE COMMITTEE OF HER MAJESTY'S MOST HONOURABLE PRIVY COUNCIL ON EDUCATION.

1. The Lords of the Committee of Council on Education consider the subject of Science Instruction in Training Colleges. They believe that the time has arrived when a special examination should be instituted at a period of the year better adapted to the Training Colleges than May; and that the nature of the examination and the payments made on the results should be modified to suit the circumstances of those Colleges.

2. They therefore determine that in future a special examination in Science shall be held in Training Colleges in December, immediately before the ordinary Christmas Examination.

3. The examination will not be open to Acting Teachers. It will be held in those subjects only for which a special course of instruction is provided in the time table of the College, and will be conducted by one of Her Majesty's Inspectors, or by an officer of the Science and Art Department.

4. No Student in a Training College will be allowed to attend the May examinations of the Science and Art Department.

5. The examination will be confined to the following ten subjects:—

1. Mathematics.
2. Theoretical Mechanics.
3. Applied Mechanics.
4. Acoustics, Light, and Heat.
5. Magnetism and Electricity.
6. Inorganic Chemistry, including Practical Chemistry.
7. Animal Physiology.
8. Elementary Botany.
9. Physiography.
10. Principles of Agriculture.

6. No Student will be permitted to take up more than two subjects in any one year. Women will not be permitted to take more than one subject in a year.

7. The examination, except for Mathematics, will be based on the syllabus of the several subjects given in the Science Directory. But the two stages, Elementary and Advanced, will be treated as a whole—one paper only being set. These examination papers will be framed much as the present May papers are framed, that is to say, with a certain number of compulsory questions and a certain number of optional questions, some of the latter being more difficult, and more highly marked, than the rest. Questions will also be set on the method of teaching various branches of the subject. The syllabus for the Mathematical examination is given in the Appendix.

8. The successful Students will be placed in the 1st or 2nd Class, the standard for a 2nd Class being as high as that of a good 2nd Class in the present Advanced Stage, and for the 1st Class of a good 1st Class in the Advanced Stage.

9. All Students who pass will be registered as qualified to earn payments on results and will receive certificates, but no prizes will be given.

APPENDIX.

SYLLABUS FOR MATHEMATICS IN TRAINING COLLEGES.

Geometry—
All the propositions of plane geometry; including the doctrine of proportion, so far as it is treated in the definitions of the fifth and in the sixth book of Euclid.

Algebra—
Up to indeterminate coefficients and continued fractions.

Logarithms—

Trigonometry—
So far as it is required for the measurement of triangles, areas, heights, and distances.

Solid Geometry—
First principles, including the volume and surface of the right cylinder, cone, and sphere.

A Student who passes in this subject will be registered as qualified to earn payments on results in Stages 1, 2, 3, and 4 of Mathematics.

N.B.—1. *A Student may not, in his first year, take up more than two special subjects, nor, in his second year, more than four.*

2. A Student, who, at the end of his first year, passes with credit in History, or Geography, or both, may in his second year omit such subject, or subjects.

3. A Student who fails to pass with credit in either, (or both,) of these two subjects, must take it, (or them,) up again in his second year, and may not, in that year, take up more than three (or two) special subjects.

4. *A Student will be required to present himself at the end of his second year for examination in any science in which he may have failed to obtain at least a second class at the end of his first year; such subject or subjects will be considered as the first of the optional science subjects to which he may be entitled by the foregoing rules.*

5. Acting Teachers, who attend the Christmas Examination, will receive additional marks for any two of the specified Science Subjects, in which they may have obtained a first or second class in the Advanced Stage or in honours, at one of the May Examinations held by the Science and Art Department.

Correspondence.

St. Paul's Board Schools,
Hounslow Heath,
4th November, 1882.

DEAR SIR,—Will you please kindly allow me a small space in your excellent PRACTICAL TEACHER to ask any of our able correspondents if they will please give information on the following?—In the 'Grammatical Questions' for PRACTICAL TEACHER last July, three of the exercises were taken from Tennyson, and two were taken from the same author for last November, and it may be noticed that these exercises have often been selected from this author.

I should be glad to learn from which of Mr. Tennyson's works they are taken, and is there such a thing as a very cheap edition of this work or these works issued? Perhaps some able correspondent who is familiar with this author will kindly inform me.

I am, dear sir,
Yours faithfully,
E. MARTIN.

ERRATA.—Scholarship Examination, last month's issue:—
For 4 read $4x$ in divisor, lines 2 and 3. Ex. 8. Algebra. (Simplify, etc.)
For $16\frac{1}{2}$ read $17\frac{1}{2}$. Ex. 9. Arithmetic.

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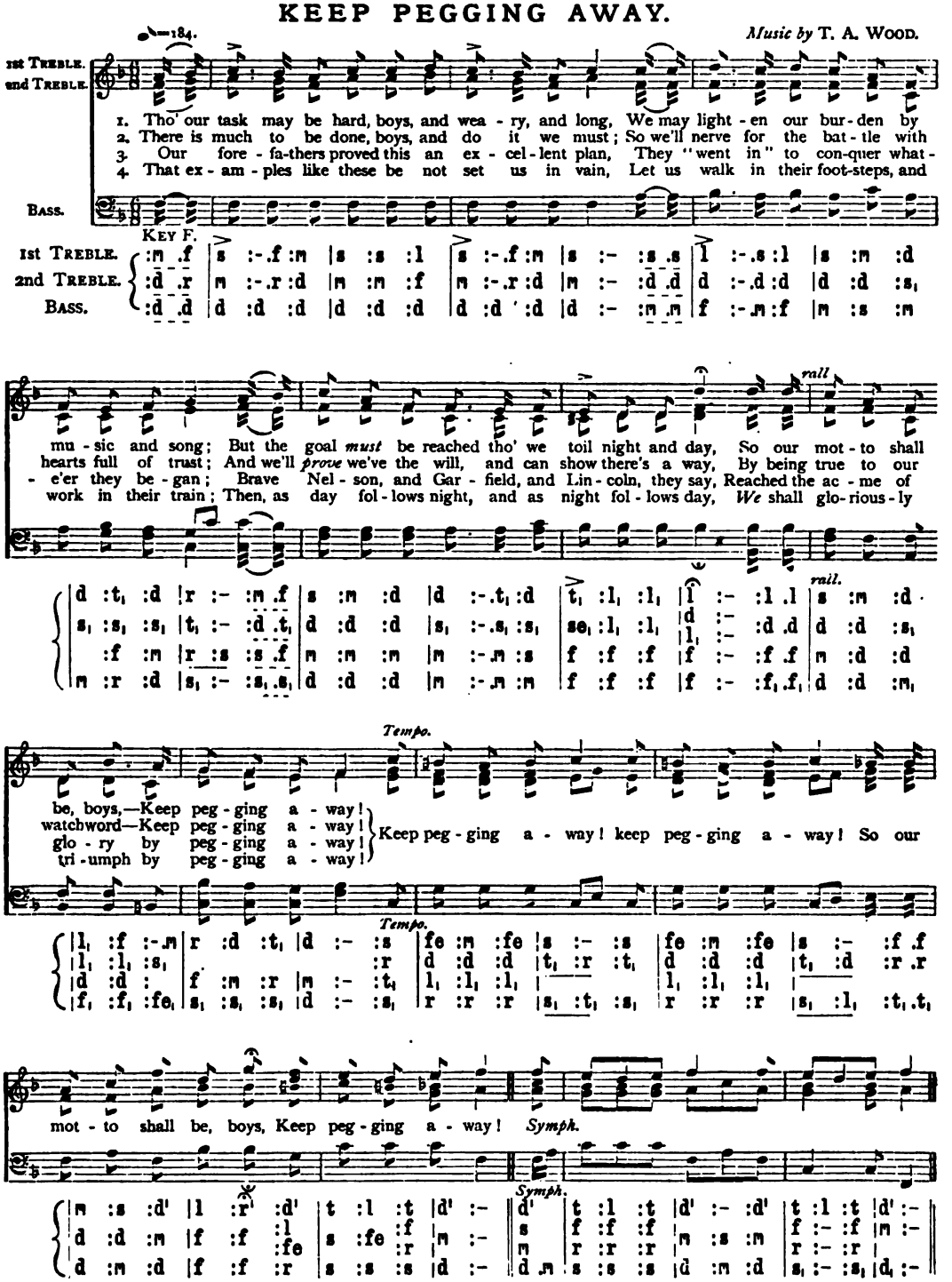
* For information respecting the examinations in Science and Art, and for copies of the Science and Art Directories, application may be made to 'The Secretary, Science and Art Department, South Kensington, London, W.'

† In 1883 the passages will be taken from *Cæsar de Bello Gallico*, Book III., Virgil's *Æneid*, Book VI., Xenophon's *Anabasis*, Book III., Euripides' *Medea*, Bonnechose's *Lazare Hoche*, Racine's *Iphigenie*, Goethe's *Italian Journey*, and Schiller's *Maria Stuart*. In 1884 the passages will be taken from *Cæsar de Bello Gallico*, Book II., Virgil's *Æneid*, Book II., Xenophon's *Anabasis*, Book II., Euripides' *Alcestis*, Saintine's *Picciola*, Book II., Racine's *Iphigenie*, Goethe's *Italian Journey*, and Schiller's *Maria Stuart*.'

KEEP PEGGING AWAY.

Music by T. A. WOOD.


♩=184.
1st TREBLE.
2nd TREBLE.
BASS.
1. Tho' our task may be hard, boys, and wea - ry, and long, We may light - en our bur - den by
2. There is much to be done, boys, and do it we must; So we'll nerve for the bat - tle with
3. Our fore - fa-thers proved this an ex - cel - lent plan, They "went in" to con-quer what -
4. That ex - am - ples like these be not set us in vain, Let us walk in their foot-steps, and
KEY F.
1st TREBLE.
2nd TREBLE.
BASS.
mu - sic and song; But the goal *must* be reached tho' we toil night and day, So our mot - to shall
hearts full of trust; And we'll *prove* we've the will, and can show there's a way, By being true to our
- e'er they be - gan; Brave Nel - son, and Gar - field, and Lin - coln, they say, Reached the ac - me of
work in their train; Then, as day fol - lows night, and as night fol - lows day, *We* shall glo - rious - ly
rall
rall.
Tempo.
be, boys,—Keep peg - ging a - way!
watchword—Keep peg - ging a - way!
glo - ry by peg - ging a - way!
tri - umph by peg - ging a - way!
Keep peg - ging a - way! keep peg - ging a - way! So our
Tempo.
mot - to shall be, boys, Keep peg - ging a - way!
Symph.
Symph.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

STANDARD IV.

A. 1. £34,290 15s. 6½d.
2. £16 5s. 4⅘d—2.
3. 1,344,000 ozs.
B. 1. £48,271 1s. 11⅗d.
2. £45 19s. 6½d.—81.
3. 21 ton 5c. 1q. 6lb. 9oz.
C. 1. 839,601 sq. in.
2. £7 7s.
3. £6 12s. 4⅘—3653.
D. 1. £177,136 9s. 10½d.
2. 139,392 sq. yards.
3. £23 10s. 1½d.—367.
E. 1. 175 coats—2 yards 3 inch left.
2. £1,011 10s.
3. 31,536,000 sec.
F. 1. 60 days
2. 1,416yd. 2q. 2nl. 1½in.
3. 12 w. 3 d. 23 h. 59 m. 43 s.

ADVANCED EXAMINATION.
1. £66 16s. 10½d. gain.
2. £414.
3. 57 cows.

STANDARD V.

A. 1. £107 13s. 11½d.
2. £291 7s. 11½d.
3. 196.
B. 1. 5s. 11½d.
2. £2,605 15s. 7½d.
3. £25 14s. 0⅘d.
C. 1. £68 18s. 6⅘d.
2. £62,884 11s. 7⅗d.
3. £92 18s. 6⅘d.
D. 1. £611 2s. 4⅘d.
2. £41 11s. 11d.
3. £2,514 16s. 9d.
E. 1. £145,192 15s. 7⅗d.
2. £7 4s. 10$\frac{8}{119}$d.
3. 459.
F. 1. £40 7s. 4d.
2. 256½ miles.
3. £11 2s. 6$\frac{3}{10}$d.

ADVANCED EXAMINATION.
1. £13 10s. m., £4 10s. w., £1 10s. b.
2. £54 10s. 11d.
3. 10 to 9.

STANDARD VI.

A. 1. $\frac{3}{10}$.
2. ·15390625.
3. £25 8s. 11$\frac{1}{7}$d.
B. 1. £2 13s. 3·744d.
2. 28$\frac{18}{19}$.
3. 50 days.
C. 1. $\frac{31}{32}$.
2. ·285.
3. 405 lb.
D. 1. £35 1s. 4$\frac{96}{125}$d.
2. ·000002$\overline{1875}$.
3. £18 11s. 10½d.
E. 1. 1·499349+
2. $\frac{7}{33}$.
3. $\frac{499}{1250}$.
F. 1. ·000003.
2. m. £7 6s. 8d., w. £6 2s. 2½d.
3. £770 9s. 2·9352d.

ADVANCED EXAMINATION.
1. 9$\frac{1}{7}$ hours.
2. £9 8s. 10½d. gain
3. 1$\frac{49}{176}$ days.

STANDARD VII.

A. 1. £27 7s. 2⅖d.
2. £89 17s. 7$\frac{7}{11}$d.
3. 3$\frac{8}{11}$ per cent.
B. 1. 3,607.
2. £8 0s. 1⅗d.
3. £3 8s. 10$\frac{1}{11}$d.
C. 1. 5 1$\frac{5}{16}$ years.
2. 4s. 8·241d.
3. 85$\frac{7}{11}$.
D. 1. £101 5s.
2. £24 1s. 7·3725d.
3. 14s. 10$\frac{2}{101}$d.
E. 1. 5$\frac{13}{37}$ per cent. loss.
2. £649 2s. 5$\frac{9}{11}$d.
3. £24 2s. 3$\frac{3}{11}$d.
F. 1. 4$\frac{213}{215}$ per cent.
2. £142 13s. 7·4856961.
3. £93 16s. 10$\frac{9}{73}$d.

ADVANCED EXAMINATION.
1. £3117 10s.
2. 5$\frac{6}{73}$ per cent; 2.759+
3. £8 1s. 10½d. decrease.

SOLUTIONS OF THE ADVANCED EXAMINATION QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

STANDARD IV.

1. 3 ton 17 cwt. = 8624 lb., − 85 = 8539 lb. sold, which at 7½d. = £266 16s. 10½d. total selling price. Then £266 16s. 10½d. − £200 = £66 16s. 10½d. gain. Ans.

2. 1260 yds. = 20160 nls., and 2 yds. 2 qrs. 2 nls. = 42 nls.; then 20160 ÷ 42 = 480 lengths, which at 17s. 3d. each = £414 Ans.

3. 16 ton 14 cwt. 1 qr. 13 lb. = 37449 lb., and 15 lb. × 19 × 63 = 17955 lb. eaten by the horses. Then 37449 − 17955 = 69494 lb. eaten by the cows in 19 days, and 19494 lb. ÷ 19 = 1026 eaten in one day, and 1026 lb. ÷ 18 = 57 cows. Ans.

STANDARD V.

1. A man gets 9 times as much as a boy, hence the 60 men get as much as 540 boys, and the 80 women get as much as 240 boys; making a total of (540 + 240 + 100 =) 880 boys. Then £1320 ÷ 880 = £1 10s. a boy's share, £4 10s. a woman's, £13 10s. a man's share. Ans.

2.

		s.	d.	£	s.	d.
	25½ yards of silk at	7	6	= 9	11	3
	48½ ,, velvet ,,	8	6	= 20	12	3
	52 ,, cloth ,,	11	9	= 30	11	0
	6 doz. towels ,,		7½	= 2	3	6
	48 gross of buttons at 2½d. a doz.			= 6	0	0
				£68	18	0
	£68 18s. = 1378s., at 2½d. each			= 14	7	1
				Ans. £54	10	11

3. 18 × 1½ = 27 women's day's work in 9 acres, and 1s. 6d. × 27 = 40s. 6d. cost of 9 acres = 4s. 6d. an acre done by women. It is easily seen from the question that a man does ½ an acre a day, and therefore the cost done by men is 5s. an acre. Hence the ratio is 5 to 4½ = 10 to 9. Ans.

STANDARD VI.

1. 2½ miles − 1⅜ (or $\frac{11}{8}$) miles = 1⅛ = $\frac{9}{8}$ miles. Then by proportion, $\frac{9 \text{ hr.} \times 20 \text{ m.} \times 10 \text{ d.} \times 9 \text{ length}}{18 \times 9 \times 11} = 9\frac{1}{11}$ hrs. Ans.

2. ·035 of £4670 = £163·45 cost of the cloth. ·475 of 300 yd. = 142·5 yd., and £·575 × 142·5. = £81·9375. 300 − 142·5 = 157·5 yds. the rem. ·55 guinea = £·5775. £·5775 × 157·5 = £90·95625. £81·9375 + £90·95625 = £172·89375 total selling price. £172·89375 − £163·45 = £9·44375 = £9 8s. 10½d. Ans.

3. $\frac{1}{12}$ + $\frac{3}{16}$ = $\frac{13}{48}$ frac. of an ac. done by A and B in 1 hr. 3 ac. 1r. 15 p. = 3$\frac{13}{40}$ ac. = $\frac{133}{40}$ ac. Then ($\frac{133}{32}$ ÷ $\frac{13}{48}$ ÷ 9½) = ($\frac{133}{32}$ × $\frac{48}{13}$ × $\frac{2}{19}$) = $\frac{1596}{3952}$ = $\frac{399}{988}$ days. Ans.

STANDARD VII.

1. (£780 × 4½) ÷ 100 = £35·1
(£935 × 3⅜) ÷ 100 = £35·0625
} = £70·1625 interest on (£780 + £935 =) £1715. But the interest on £1715 at 5 p. ct. = £85·75, hence £85·75 − £70·1625 = £15·5875 short of 5 p. ct. on the £1715, to be made up by the extra ½ p. ct. on the amount at 5½ p. ct., £200 of which will make £1 additional interest. Then £15·5875 × 200 = £3117 10s. Ans.

2. 3$\frac{1}{16}$ − 3⅛ = 1$\frac{5}{16}$ million gallons increase, being on $\frac{5}{16}$ millions,—hence the increase is $\frac{1}{16}$ on the original quantity, and $\frac{1}{16}$ of 100 = 5$\frac{5}{16}$ per cent. increase in quantity. Ans. £905,400 − £880,420 = £24,980 decrease in value. Then $\frac{24,980}{905,400}$ of 100 = 2·759+ per cent. decrease in value. Ans.

3. £3½ × 37 = £129 10s. annual income from 3½ p. cts. £87½ × 37 = £3237½ cash received on selling out. £3237½ ÷ 80 = 40$\frac{15}{16}$ hundreds of 3 p. cts. bought. £3 × 40$\frac{15}{16}$ = £121$\frac{15}{16}$ = £121 8s. 1½d. Then £129 10s. − £121 8s. 1½d. = £8 1s. 10½d. decrease in income. Ans.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

EXERCISE XIII.

(1) 6. (2) $\frac{1}{4}(a+b+c+d)$. (3) 7. (4) -4. (5) 3. (6) -3 (7) -3. (8) $\frac{3}{4}$. (9) 6. (10) $\frac{1}{4}$. (11) 2. (12) $\frac{12}{m-n-p}$. (13) $\frac{11}{17}$. (14) $\frac{22}{a+b+16}$. (15) $\frac{38}{3-a}$. (16) $11\frac{11}{17}$. (17) 1. (18) $3\frac{11}{17}$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE LITTLE LEARNER,' FOR JANUARY, 1883.

STANDARD I.

A. (1) 22
(2) 51
(3) 206

B. (1) 107
(2) 185
(3) 258

C. (1) 317
(2) 892
(3) 2,573

D. (1) 890
(2) 1,634
(3) 2,582

E. (1) 54
(2) 521
(3) 507

F. (1) 25
(2) 27
(3) 8

G. (1) 273
(2) 745
(3) 266

H. (1) 99
(2) 34
(3) 4

I. (1) 9,071
(2) 12,447
(3) 28,584

J. (1) 2,907
(2) 1,324
(3) 779

STANDARD II.

A. (1) 71,013
(2) 69,502
(3) 349,864

B. (1) 5,516
(2) 73,957
(3) 1,235

C. (1) 61,236
(2) 539,400
(3) 1,085,007

D. (1) 1,965,180
(2) 4,825,620
(3) 10,195,200

E. (1) 2,216,592
(2) 2,936,466
(3) 4,025,230

F. (1) 47,289,242
(2) 20,030,320
(3) 64,345,491

G. (1) 21,805
(2) 18,061 + 2
(3) 9,087

H. (1) 9,334 + 6
(2) 4,769
(3) 8,199 + 10

I. (1) 6,497 + 51
(2) 68,384 feet
(3) 65 apples

J. (1) 4,658,986,920
(2) 178 marbles
(3) 48 oranges

K. (1) 7,089 + 32
(2) 1,160,496 pens
(3) 92 nuts

STANDARD III.

A. (1) 1,608
(2) 2,344 + 14
(3) 1,689

B. (1) 7,360
(2) 6,136 + 27
(3) 10,110 + 46

C. (1) 943 + 123
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Science Notes.

A NOVEL APPLICATION OF THE ELECTRIC LIGHT.—Among the most recent uses to which the electric light has been put, none more ingenious has been noticed than its introduction into dentistry. A well-known dentist has taken advantage of it to enable him to carry out his operations under more favourable conditions than the ordinary ones. He uses a small incandescent lamp to illuminate the cavity of the mouth of the patient. It is fitted into a vulcanite cup, which serves as a prop to keep the jaws apart.

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ELECTRIC RAILWAYS.—Since these have been brought into partial adoption, the attention of many engineers has been devoted to improvements in the details of their working. Among new patents which are calculated to effect these, is one taken out by Edison, which is specially directed to prevent what has caused so much difficulty in working them, viz., tbe leakage of the current. Edison's new plan is to construct the ends of the rails and the fish-plates of nickel, and to have a copper strap between the rail and the fish-plate. Further, he proposes to have the rails japanned except on the top, and to cover the ties with an insulating compound. By these means he expects to reduce the leakage to a minimum.

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THE new electric railway between the Giant's Causeway and Portrush was tried last month with fair success. Several experimental runs of over a mile each were made, with the result of attaining a speed of about ten miles per hour.

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PRUSSIC ACID IN THE ANIMAL KINGDOM.—A curious myriapod has lately been observed in several hothouses in Holland, which appears to possess the remarkable property of producing prussic acid. On irritating the creature in any way it was noticed to give out a distinct smell of bitter almonds, and this was observed to be much more powerful if it were crushed. When some of these myriapods were killed and their bodies bruised with water, and this distilled, prussic acid was found in the distillate. Herr Egeling took the matter up, and made a series of investigations into it. His results lead him to the conclusion that the animal prepares or secretes a substance which under certain conditions is decomposed, giving prussic acid as one of the products of such decomposition. Various reagents he applied enabled him to ascertain the presence of such a substance, and probably another body which acts as a ferment, causing the production of the prussic acid, under certain conditions of excitement, in the living body. The myriapod is a foreign species of Fontaria.

POWER OF RESISTING POISONS IN INSECTS.—Some interesting experiments have been carried out lately by Mons. Fredericq, of Liege, on the large water-beetle (*Dytiscus*). He put several of these insects into aqueous solutions of urari (the Indian arrow-poison) and into solutions of strychnine of poisonous strength. A few drops of his solutions were sufficiently potent to kill a frog in a very few minutes. The beetles showed themselves in most cases quite unaffected by the poison; some experiments lasted for fourteen days, at the end of which they were apparently unharmed. Other beetles besides Dytiscus also showed themselves proof against the action, some maintaining themselves uninjured for nearly a month.

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COAL IN THE UNITED STATES.—The coal supply of America has lately been attracting considerable attention, some rich seams having been discovered in the Southern States. It is not many years since the great fields of Pennsylvania were the only known deposits in the States; but recently large territories in Kentucky, Tennessee, Georgia, and Alabama have been found to be rich in the mineral. The extent of these territories is not less that 15,000 square miles, or four times that of the coal-field in Pennsylvania. Texas, also, is considered to be above a coal-field, which is thought to be of about 6,000 square miles extent. In both the coal is described as being exceedingly bituminous and of excellent quality. Some veins of good soft coal are being worked in the Indian territory, in Kansas and Missouri. The mines of the Osage Coal and Mining Co., which are situated at Macallis in this district, are among the best in the country. The coal turned out from them is described as being almost equal to the English Cannel, and as being free from impurities. It is already in very great demand over all the adjacent railways. The great Missouri basin, in which the deposits are found, is estimated to cover 84,000 square miles of territory. The Appalachian coal-field extends towards the south, becomes narrower as it crosses Kentucky, and widens again in Tennessee. Beyond this it expands across the north-west corner of Georgia, and enters Alabama, terminating in the vicinity of Tuscaloosa. It is estimated that in the State of Alabama alone enough coal will be yielded to supply the whole country for a century.

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THE BRITISH ASSOCIATION.—It is announced that Mr. A. G. Vernon Harcourt, M.A., F.R.S., has been elected General Secretary of the British Association, in the room of the late Professor Balfour.

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THE LATE PROFESSOR CHALLIS.—Astronomy at Cambridge has recently suffered a great loss in the death of the late Professor. He had lived and worked in the University for nearly a lifetime, and had done great things for the study of the science there. His own attainments as an undergraduate were remarkably brilliant, for he was Senior Wrangler and first Smith's prizeman of his year. He succeeded the late Astronomer-Royal, Sir G. Airey, as Professor.

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A NEW FORM OF LOCOMOTION.—A great improvement in travelling by road is foreshadowed by a new invention of Messrs. Ayrton and Perry, in the shape of a tricycle, which is to be propelled by electricity. It is not a very great modification of the ordinary tricycle of recent days, the same shape being preserved, and the apparatus for the application of the motive power being comparatively inconspicuous, or, at any rate, not attracting more attention than a traveller's ordinary luggage. Close to the driving wheel of the tricycle, as we know it, is fixed a large wheel furnished with a number of teeth. A motor is slung from the seat platform, the armature spindle of which carries teeth which gear into those of the wheel. The battery is composed of a number of Faure cells, which are slung from the back-bone and axle. When fully charged these contain an amount of energy equal to two horse-power. The motor and battery together weigh not quite 150 lbs. The speed with this arrangement will be about six miles per hour, but by using more accumulators it can be worked up to eight. The steering handle and the brake occupy their usual positions, and at the left side of the rider is a commutator, by which the number of accumulators in the circuit can be altered, or the current cut off from the motor. The full power of the battery is only obtained by turning the switch of the commutator through the intermediate powers, so that shocks are avoided in starting the machine.

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AGRICULTURAL CHEMISTRY.—Some experiments have been reported recently bearing on an interesting problem in Agricultural Chemistry, viz., the alteration of nitrates in the soil. A small vegetable organism, Bacillus armylobacter, has been discovered to be active in setting up a butyric fermentation in the ground. The organism has been examined while in an active condition, in a fermenting liquid which was prepared from earth mixed with sugar, and containing nitrates in small quantity. When this was kept at a temperature of 35°C. gas was given off, which was sometimes a mixture of CO_2 and hydrogen, and sometimes CO_2 with nitrogen and nitric oxide. At the same time the liquid smelt strongly of butyric acid, and the nitrates disappeared. The Bacillus described as effecting this change is widely distributed, and can be observed as a number of oblong particles collected into groups of two or three in liquids properly prepared. The nitrates in the soil are reduced by the hydrogen generated in the butyric fermentation, set up by the organism when it meets organic matters in the absence of oxygen.

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Publications Reviewed.

On Physical Education and its Place in a Rational System of Education. By Concordia Löfving. ' London: W. Swan Sonnenschein & Co.

We are very sorry not to be able to speak in unqualified praise of this lecture, which, extending to nearly 70 8vo pages, may be more properly termed a treatise. Miss Löfving is an earnest and zealous advocate of education in its fullest sense, and speaks, as we should expect from her charming portrait, with enthusiasm on all things in general that have a bearing, direct or indirect, on education. From the title of the book we look for hints at least, if not directions, on physical training, but of these the book contains scarcely anything, and merely refers us to Ling's method, the leading principles of which are cursorily glanced at. Miss Löfving speaks with almost amusing naïvety of her efforts and designs, and regards her lectures being welcomed in many places as 'a remarkable sign of the times.' She tells us that she is preparing a complete work on education, of which this pamphlet is a mere precursor. 'But seeing that it will take some time before I get my great work ready, and considering also the eager attention and good-will with which my lectures have been received by . . . the most prominent men in Europe, I cannot refrain from publishing them. Though I must say that to any one who has got his eyes open to the inner all-uniting oneness in the multiplicity of this phenomenal world, it is almost a sacrifice to have to give his mind out, so to say, piece-meal, falling so short of the ideal he has conceived.'

This will give a fair idea of the lofty—we had almost said inflated—style of the authoress, and of her fondness for hard and often scarcely understandable words. Yet this Johnsonian ponderosity is occasionally grotesquely mingled with words more approaching to slang than merely idiomatic terms. Between tasks for young people the authoress wisely enough recommends what we should call short *intervals*, but which she prefers to term *intercalations* for games, and just after this big word inspectors are told not to 'put the screw on' in regard to examinations. But we won't quarrel with fine words, though they tend to mar the usefulness of this book. We wish that the amiable and enthusiastic authoress had in the first place led us over a less extensive field and permitted us to rest longer and think more on the subject of her lecture. Next, that her suggestions on many important points were less vague and impracticable. For example, while recommending every conceivable subject for the curriculum of study, and 'ensured a general good parallelism in the subjects,' we have Sanscrit recommended as the right study for an adult, and for childhood, 'the beautiful and distinct sounds of the Italian, Spanish, and French languages as having an educative influence on the organs of speech.' Now against Sanscrit we have no word to say, and only wish it were more studied, if only for the clearness it gives to our ancient names, of rivers for instance. But we object to the hard, semi-nasal, disjointed sounds of the French being classed with the soft and vowel-abounding Italian. 'Only think,' says the authoress, 'what a corrective effect French, *if well taught from the beginning*, would have on the organs of speech of English children.' To which we may reply what a corrective effect would the pronounciation of English have on the organs of speech of a Frenchman, and also a German, who can never get over our *th*. As Herr Formes sang: 'And a moder she vash and ish to me,' and also Bret Harte, 'Bere is dat barty now?'

But we cheerfully acknowledge many wise and useful remarks in Miss Löfving's book, though most of these are old as the hills. Such, for instance, are her strictures against tight lacing, high-heeled boots, close-fitting bandages for infants, and other monstrosities of fashion and thoughtless custom. Still better are her condemnatory remarks against some gymnastic appliances, as parallel bars, which, she remarks, tend to push up the shoulders and injure the back. Again, on ventilation we are wholly with her, and lament the comparative uselessness of the swivel-swung window on account of its wrong slope. In regard to the impracticability of many of the suggestions we would notice Miss Löfving's recommendation that 'Each girls' school ought to have affiliated with it a model nursery, where a certain number of poor children could be received, and where the young girl could study their

treatment practically. She would there learn what is good for the child, as to food [the infant-cookery hobby would dove-tail capitally here], clothing, activity, rest, the proper care of its skin, and other organisations. She would there have the opportunity of watching its different stages of development, and the modifications in its treatment and *régime* in consequence thereof.' We fear our schoolmistresses will stand aghast at this. Cookery is bad enough, but what shall we say to the addition of a model nursery to every school?

We could have spared much of Miss Löfving's mysterious metaphysics for a few more remarks on the healthy training of girls. 'Man,' she tells us, 'is a universe in miniature, a plurality pointing towards or converging to a unity.' In regard to the action of the brain, while partially agreeing with the phrenologists, Miss Löfving tells us that 'persons of great mental activity and capability have the *gyri* or convolutions of the grey matter more numerous and more distinctly grooved than in the brains of people of less ability.' Probably our imperfect appreciation of many of Miss Löfving's speculations are owing to an imperfectly grooved *gyri*, or the grey matter of our brain not being sufficiently convoluted. One word as to the theological notions of Miss Löfving in regard to the Resurrection. We can understand the material notion that insists on the union of the natural body with the spirit, and we can also understand the Swedenborgian belief of the entire separate existence of spirit, in fact that there is a spiritual body as well as a natural body, and that the latter will not be required in the spiritual world. But Miss Löfving's hazy theory hereon puzzles us. She says that man has 'the hope of a more perfect union between spirit and matter, where the bodily element shall share immortality with the spirit.' Yet, 'the above, of course [why of course?], does not mean that the same body that you lay down in the tomb rises again; such an idea would be against Scripture (1 Corinth. xv. 37-44), as well as against the revelations of science respecting the circulation of matter!' We ought to apologise for thus introducing theology into physical education, but would with all gentleness suggest to Miss Löfving that such matters are inappropriate to her subject and militate against the utility of her pages. We have, however, much to commend and little to object to in these pages, notwithstanding their vast and rather vague range, and we must add, that of the good things brought forward by Miss Löfving far less are new than the gentle authoress seems to imagine.

Student's Manual of German Literature. By E. Nicholson, Author of 'Chronological Guide to English Literature.' Swan Sonnenschein and Co., Paternoster Row.

A catalogue *raisonnée* of the best Teutonic authors, with some account of their chief works, divided into seven periods, ranging from the fourth century to the nineteenth; and for an eighth giving a rapid list of writers of Germany, for the most part still living. The Gothic translation of the Bible, as the most ancient (for it was made in A.D. 388), is also the most interesting, and is named the Silver Codex. Among many others of the Saga sort, the famous Nibelungenlied is treated at the considerable length its importance deserves. It is impossible to name every noted German author, but Mr. Nicholson has here introduced his student wisely and widely to the best.

The Book of Shadows. London: Sonnenschein.

" Some of these whimsicalities are ingenious, but others too far-fetched. It seems scarcely worth while for the labour of woodcuts to have been wasted on such silliness. However, it is but a sixpennyworth.

Cat and Dog Stories as told to one another. London: Sonnenschein.

Another of this firm's sixpenny series, and a very good one. The animal sketches are very clever, and the anecdotical letterpress quite the thing to improve the minds of children towards love of their home pets.

Sixth Reader. (Blackie's Graduated Readers.) Edited by Maurice Paterson. London: Blackie and Son.

Among the numerous competitors for scholastic patronage in the way of General Readers, we must award great praise to the one before us. We are disposed to be increasingly critical amid so many ordinary selections and compilations, but this book disarms all complaint and demands commendation on many points. In the first place, the selections are always good. Next, they are in many cases fresh, while some of the best old bits, both of prose and poetry, are retained. Further, we have a remarkably excellent set of notes appended to every lesson which admirably elucidate the text, and will thus save the teacher very much trouble. The questions also will probably be useful to many teachers, and need not be regarded as exhaustive if followed slavishly. To give some idea of the attractiveness of the contents, we may mention a series of extracts from Chaucer, hitherto almost neglected; several excellent lessons on scientific subjects mostly compiled; a judicious admixture of historical, legendary, poetical, and descriptive matter of general interest and most suitable to the upper standards.

Historical Reader. No. II. By George Girling. London: Blackie and Son.

This book forms one of Blackie's Comprehensive School Series, and gives an outline of English history from the commencement of the Tudor times to the present. Mr. Girling has carefully considered his subject, and shows great skill in presenting the most important facts in a style eminently suitable for junior standards. This style, while being simple, is free from the affectation of writing down to supposed imperfect comprehensions. In short, it is good, plain English, and in saying this we are saying much that we cannot say to many school histories. There is also a remarkable fairness throughout, though by no means a colourless spirit. A judicious admixture of political facts with the progress of the nation, also marks these chapters. In regard to the latter, we have such pleasant and truly instructive summaries as the following:—'In spite of the unsettled condition of affairs during the Civil War the country was advancing in material prosperity, and under the Commonwealth commerce received a great impetus. The population of the country in the reign of Charles II. was about five and a half millions. The cotton manufacture was introduced into the country during the early part of the period, and Manchester became its principal seat. Many of the great towns of the present day were small and insignificant, or were just rising into importance. The roads of the country were in a wretched state, and communication [was] difficult. In 1662 the Turnpike Act was passed, but there was no great improvement in the roads till the time of the Georges. At the end of the seventeenth century stage-coaches were introduced, and journeys from London to Chester, York, or Exeter took about four days in summer and six in winter.' In this agreeable fashion, the author gives us the most prominent features of English history. The book is also well got up, excellently printed, well illustrated, and strongly bound.

Historical Reader. No. III. Adapted to Standard V. of the Education Code. By George Girling. London: Blackie and Son.

This book comprises the outlines of the history of England from the British to the end of the Tudor period, and merits more than usual attention from the evident carefulness of the author in consulting good authorities and presenting his conclusions in a very suitable style. A remarkable spirit of fairness pervades the chapters, together with a departure from the beaten track of many old errors. In this latter respect we are struck with the clear

summary of Ancient Britain, the subject on which many mere compilers come to grief. Mr. Girling gives us a few leading authorities for his comprehensive sketch of this period. We only regret that this chapter is so short, but are thankful for its trustworthiness. The first Roman Invasion under Cæsar is dismissed in a short paragraph, of which we suppose we must not complain. But the traditional place where Cæsar crossed the Thames at his second invasion has become disputed, and may perhaps be better less confidently stated to be at Coway Stakes, near Chertsey. Staines and Kew Bridge each set up a claim in this respect. The Britons were not so destitute of military skill on the departure of the Romans as Mr. Girling would have us believe, but gave way before the Picts and Scots mainly through their internal differences and tribal quarrels. The sketch of the advance of Jutes, Saxons, and Angles is well summarised, as is also the general account of the Saxon period. We would willingly not except from this the legendary account of Alfred's gaining a book as a prize from his mother, Osberga, but this pretty little story must be relegated to the limbo of chronological anachronisms. Now and then we are treated to a pleasing little bit of etymology in explanation of names. That of 'King,' we are told, is from *Cyn*, a race or tribe, and *ing*, son of; hence *Cyning*, contracted to *king*, the son of the nation. 'The wife of the king (*cwen*, hence *queen*) originally shared the honours with her husband,' etc. It is pleasing to trace the meaning of this word *queen* or *cwen* to *white*, *bright*, or *shining*. Hence the old name of the White Sea was *Cwensea*, and from the same root—probably old Sanscrit—we have the names of *Kent*, *Kennet*, *Cann*, and others. A very much better account of the Saxon people and government is given by Mr. Girling than by many compilers. In this he has shown better judgment than by giving us many details of celebrities from the old Saxon chronicles. It is in this way of judicious selection that a good school history is most shown, and Mr. Girling has well succeeded in this particular. The get-up of the book is most satisfactory, being beautifully printed, well illustrated, and strongly bound. Many of the illustrations are facsimiles of old objects, such as the accoutrements of the Black Prince in Canterbury Cathedral; others are capital specimens of modern wood-engravings. There are also a goodly number of suitable and explanatory maps.

Stories of Old Renown, etc. Told by Ascot R. Hope; illustrated by Gordon Browne. Blackie and Son, Old Bailey.

This beautiful gift-book, perfect in paper, type, engravings, and most tasteful binding, deserves all our praise: the illustrator in particular outvieing Corbould in his knightly figures both of man and horse, and Richard Doyle in his humorous vignettes. Never was seen such a dragon as Sir Guy combats in p. 104 (more than a match for Turner's sublime monster on the ridgy Alp), while the sketch tournament (p. 34) of the brace of warriors transfixed by each other in the air with their horses butting like rams beneath is full of wit and wisdom. The stories, too, are well told, albeit sufficiently familiar; there is patient Griselda, worried for years by her capricious Marquis of Saluces, the most unreasonable and cruel husband ever invented; also, the much-maligned Genevieve of Brabant, tormented to her death by that base seneschal Golo; the tale of the false tutor Dissawar and his betrayed ward Roswall; of Robert of Sicily, a parallel for humbled pride with Nebuchadnezzar; of Guy of Warwick, and Ogier the Dane, and divers other impossible heroes of old time, whose records, founded in the humblest of barbaric fact, have come down to us in the most exaggerated form of incredible unreality. For example, we are told (p. 60) with respect to Charlemagne that 'A hundred knights [each], with a naked sword in one hand and a burning torch in the other, watched [as a matter of nightly custom] round the emperor's bed while he slept'—poor man, how could he sleep?—and 'when he went out to hunt, a hundred barons rode by his side'—it may be hoped, only to escort him to the covert. But let us not be prosaically critical on such picturesque descriptions. The book is, as we say above, worthy of all praise and deserves a great success.

Four Little Mischiefs. By Rosa Mulholland. Blackie and Son.

The children whose doings are recorded in this story really do get into such a series of scrapes, especially when staying at a country farmhouse, that they well deserve the name of 'Four Little Mischiefs.' But they are not bad children, only so fond of fun and frolic that even at their worst no one can be seriously angry with them, and their kind-hearted liberality when the poor little circus-rider meets with an accident proves the goodness of their dispositions. No doubt the story will find many little readers equally fond of mischief; but it is to be hoped they will not drive mother or nurse wild by imitating the pranks of Jork and Bunko.

Naughty Miss Bunny. By Clara Mulholland. A Story for Little Children. Blackie and Son.

Bunny is a dear little pickle of six, an only child who says 'it's because she feels lonely that makes her want to play tricks on people.' This is remedied by the arrival of a small boy cousin from India, but Bunny still remains delightfully naughty. She is quite a touch of nature, and will win the hearts of her readers.

The book is a pretty gift for a little girl, although the illustrations might be better. The cover is very attractive.

Chambers's Historical Readers. Book III. London and Edinburgh: W. and R. Chambers.

This book comprises the outlines of English history from the accession of Edward III. to the Stuart period. It is marked by impartiality and a disposition to give a truthful impression of the leading features of England during the Middle Ages. Occasionally useful observations occur elucidatory of the effects of great occurrences. As, in speaking of the French wars, the writer well observes that they tended to bind the English nation together. 'The races of Norman and Saxon forgot their differences, and learned to glory in the common name of Englishmen. They had marched and won side by side, and all classes felt a common pride in the country that could send forth such brave men.' As a proof of this, a statute was passed (in 1362), ordering that all proceedings in law should be conducted in English instead of in French, as had hitherto been the case. In fact, by this time the French spoken by the Normans had very much gone out of use, and had given way to the common popular speech, which Chaucer did much to bring into a permanent form. While the principal historical incidents are briefly described, due attention is paid to the social condition and progress of the people in material comforts. Of course such notices are but cursory, owing to the limits of the book, but what has been done has been well done. The book is well got up—printing, illustrations, maps, and binding being most commendable. Among the illustrations are some portraits—that of Raleigh, for instance—of unusual excellence. Judicious poetical extracts, chiefly from Shakespere, are agreeably interspersed among the prose lessons. Chronological and genealogical tables form useful appendages to the chapters.

Taunton Arithmetical Test Cards. In Six Packets for Standards II. to VII. By H. Allen. London: W. and R. Chambers.

This is, in all respects, an excellent set of cards. There are forty different cards (the colour of which varies with each standard) in each packet, in addition to two copies of answers on cards. It would be difficult to select a better set of exercises for use a month or two before the inspection.

We, therefore, cordially recommend Mr. Allen's Taunton Test Cards.

History of England for Standard IV. Part I. By A. H. Dick. London and Edinburgh: Gall and Inglis.

The author begins this little book with the first Roman Invasion of Britain. This is associated with a brief account of the Britons at that period, which is so misleading that we wish it were altogether omitted. The Druids are represented as a set of Thugs presiding over human sacrifices, notwithstanding opposite conclusions, together with the well-known fact that the Gauls sent their sons over to Britain for the advanced education under the Druids. In regard to the Saxon conquest, we have nothing better than the old exterminatory theory of the Britons that remained in their land together with the others being 'driven to the mountainous districts of Wales, Cornwall, and Cumbria,' wherever that may be. The sketch of the Saxon times, or rather of a few of the most prominent kings, is fairly told. Alfred, we hear, won for himself not only the name of *great*, but 'the no less distinguished title of "Founder of the English Monarchy."' This is not stated in any of the Saxon chronicles now recorded by any modern annalist of repute. The Norman rule is described in no unpleasing manner, and is gratefully free from tiresome dates of battles and mere names. In this respect it contrasts favourably with a host of repulsive skeletons that are made to do duty as histories for young readers. Of course we have the mythical story of the death of Rufus by Tyrrel's arrow, and after this has been dramatically given, even to the king's exclaiming, 'Shoot, Walter, shoot!' and 'As the words were spoken, the arrow came whizzing into the king's body, he fell, and died in a moment (1100),' we are in the next paragraph led into the path of historical scepticism in regard to this particularly detailed circumstance by the tantalizing question, 'Had Tyrrel shot the king?' which is more tantalizingly answered, 'No one knows.' The narrative, however, is in most other respects made up of less disputable stories, which are told generally in a moderately simple style. The account of the signing of Magna Charta tallies with local tradition. Runnymead, now better known as Egham Racecourse, lies between the Thames and the large village of Egham. In the midst of the river is a small island belonging to the Aukerwycke estate and named Magna Charta Island. On this is a cottage in which visitors are shown several things connected with the great historical event. The latter part of Mr. Dick's narrative comprises a sketch of Scottish history down to the early part of the fourteenth century, and thus includes the romantic careers of Wallace and Bruce. The book is well got up, and in regard to the illustrations the only fault we have to find is the gigantic stature of Peter the Hermit, who must have been at least ten or twelve feet in height, if we may judge by the size of his surrounding auditors.

History of England for Standard III. By A. H. Dick. London and Edinburgh: Gall and Inglis.

Much of the so-called history of the early part of this book had better remain unlearned. The general account of the Ancient Britons is erroneous, and a slavish following of exploded errors. There are already too many compilations founded on the authority of the shadowy Gildas, and which errors, having been scattered to the winds by modern authors of repute, it behoves compilers of history to avoid. Goldsmith and others, down to the irrepressible Pinnock, wrote according to their lights; the first with an inimitable charm of manner; but their lights have been shown to be in many cases set in very opaque lanthorns. If Mr. Dick has no opportunities of consulting the pages of Huxley, Nicholas, and other sound authorities, we recommend to his attention a clear little account of *Celtic Britain* by Professor Rhys, from which he may eliminate a host of errors he has made in the first part of his book. One or two instances will be sufficient to prove the truth of our objections. 'Ships,' Mr. Dick says, 'seldom came to the shores [of Britain], and did not come to bring things to the people, but only to get tin and lead.' We say nothing about this strained attempt at simplicity, but most well-read pupil-teachers could tell the author that the Britons *exported* not only metals of various kinds, but also corn, cattle, skins, fleeces, and especially a famous breed of dogs. They also imported, among other things, ivory, bridles, cups of amber, and drinking glasses. Such articles speak of a much higher civilization than that of savages, gratified with glittering beads and tinsel shreds of paper, in which condition Mr. Dick would have us believe the Britons to have been. Speaking of the Roman attack under Cæsar, we read, 'The poor naked Britons with their bows and arrows and soft copper swords (!) were soon driven on shore.' Strabo, some time before, giving us an account of the Britons, tells us that they were 'clad in black cloaks, with tunics, which reached to their feet, and girt about their breasts' (Geog. lib. iii. 5). The houses of the Britons were also, according to Cæsar—who wrote with an evident bias against his too stubborn foes—'after the manner of the Gauls,' and thus not the mere huts of wood and rushes, as stated by Mr. Dick. Further on he tells us that 'among the Britons coined money was unknown.' This error we may suppose Mr. Dick has fallen into from the fact that the Britons used iron and other rings for some purposes of barter. But has he never heard of British coins? Is he ignorant of Mr. J. Evans' book on 'The Coins of the Ancient Britons'? Has he never seen the beautiful specimens of Cunobelin and others, now to be examined in our national collection? As the song says:—

> 'If you look you will see 'em
> In the British Museum
> In Russell Street, Bloomsbury.'

Seriously, it is time such errors disappeared from our school-books, or modern scholarship is useless. We expect something even from compilations in the elimination of error. Otherwise the remark of the farmer to his son will be applicable to our scholars, that 'Book-larnin' don't seem to get you much forrarder.' The printing, illustrations, and binding of the book are thoroughly good.

Heroes of Maritime Discovery. By Davenport Adams. Gall and Inglis.

This otherwise pretty book has such an unattractive frontispiece, that one needs to consult page 8 to account for its ugliness: its hero being a hideous Patagonian, absurdly exaggerated. For the rest, twelve of our earliest adventurers contribute the interest of their exploits to the many excited schoolboys who will doubtless devour this able record thereof. It is curious that so great a name as that of Captain Cook should be omitted from the list of the Heroes, but perhaps a second volume will supply that and divers other such lackings. It is the more remarkable because one of the illustrations (and very good too), page 180, shows one of the gigantic idols of Easter Island, notably of Cook's early visiting, if not discovery; but Jacob Roggewein has here the glory of it. And the account here is of the greater importance, in that it shows there were in 1722 'many thousands of inhabitants' (page 178) in a little island now desolate and almost uninhabited, except by some 300 enormous stone images of ancient kings and priests! the explanation being that a slow subsidence of the land, as the crust of a volcanic plain, has gradually diminished this and other islands of the Pacific. In fine, Mr. Davenport Adams writes graphically, and the heroes he commemorates are worthy of all commendation.

Wesleyan Methodist Sunday-School Magazine. Vol. VIII. London: 2, Ludgate Circus Buildings.

This handsome volume cannot fail to prove of great service to all engaged in the religious training of the young. It is full of good things.

Junior Scholars' Tablet Book. Senior Scholars' Tablet Book. London: 2, Ludgate Circus Buildings.

Last year we noticed very favourably these neatly printed books, and have now equal pleasure in recommending the volumes for 1883 to mothers, Sunday-school teachers, and governesses. They are capital aids to Bible teaching.

Macmillan's Progressive German Course. First Year. By G. Eugène-Fasnacht. London: Macmillan and Co.

The fact that German is no longer looked upon as an 'extra' in our schools, but is beginning to form one of the essentials of a good education, especially among our girls, we see appearing on all sides new books and new methods for teaching German. But few authors have been so successful as Monsieur Fasnacht in providing us with an easy Primer suitable for the very beginners.

Concise clearness is the soul of good teaching, and the little book before us is both clear and concise. Each page consists of a short grammar lesson, a vocabulary of well-selected words, a model exercise in German, and some eight or ten English sentences for translation. As German grammar is one of the most difficult lessons a child has to master, we cannot speak too highly of this simple method, which at once puts him in possession of every material for constructing easy sentences, and rules for the proper use of that material.

We hear rumours of a new edition next spring, and we venture to suggest to the author that two slight additions would greatly add to the practical usefulness of his Primer. One is, that the definite article might be fully given in the first lesson instead of having to be gathered from different lessons, and the other, that some tabular form of the whole plan of the declension of nouns might be given on one sheet, by merely noting the *inflected terminations* themselves. It is utterly impossible otherwise to expect a child to have a clear idea of this most difficult subject. At present we are obliged to supply the defect by a separate table of declensions, but every one may not be fortunate enough to possess such an admirable substitute.

However, in spite of these serious drawbacks, we can heartily recommend this little book to every German teacher; and perhaps our recommendation may have some weight, when we say that, during the last two years, we have taught more than a hundred pupils with the help of no other grammar, and with the most successful results.

Greenwell's Test Cards. (Algebra, Euclid, and Mensuration.) By M. H. Senior. In Three Packets. London: Simpkin and Co.

These three packets are labelled A, B, and C, and are designed for Oxford and Cambridge juniors and for Higher Grade schools. Packet A contains addition, subtraction, brackets, definitions, axioms, and easy exercises on the square and rectangle; Packet B, multiplication, division, factors, simple equations, Bk. I., Prop. and Ex. from 1 to 32, and square and rectangle; Packet C, fractions, square root, equations, from Prop. 32, Bk.I., to end of Bk. II., and areas of rectilineal figures.

The Exercises are varied, and will furnish excellent test work for elder scholars and young pupil-teachers, as well as for Oxford and Cambridge juniors.

Graduated Exercises in English Grammar for Standard VI. By M. Hickey. London and Manchester: John Heywood.

This little book has conciseness and cheapness to recommend it—its price being only 2d. It is more definitive than explanatory, and abounds in the technicalities which have unhappily forced their way into the upper part of grammar termed analysis. For this, however, the author is neither responsible nor blameable. Yet it seemeth a matter for regre that the subject should be made dry, technical, and uninviting. Surely there is scope herein for some benevolent being to clothe these dry bones with living flesh. The definitions, however, of this little book are clear and accurate, and the exercises, selected from our best authors, well graduated.

Fairy Tales for Children: Tommy Greedy-grab and Wriggletum. By Joseph McKim, M.A. J. Heywood, Manchester and London.

Of the two stories contained in this little volume, both of slight construction, and not as cleverly written as might be, 'Tommy Greedy-grab' is decidedly the best; and all little schoolboys inclined to be lazy over their lessons, or given to greediness on the occasions of a hamper arriving from home, will do well to read Master Tommy's visit to the 'King of Tarts,' and if they follow his example they will be rewarded as he was, by finding how much more beloved he is when, on his return to school, he loses his nickname of 'Greedy-grab,' and is known henceforth by his proper cognomen 'Greenbank,' and is styled a 'brick' by his schoolfellows ever after.

(1) Jack the Giant-Killer. (2) Gulliver in Lilliput. (3) Gulliver in Brobdingnag. (4) Old Mother Hubbard.

Four of Nelson's wonderful sixpennyworths, the illustrations being firstrate, especially the 'Hubbard.' Whether or not young children should imbibe giant-killing, or can appreciate the satire of Lemuel Gulliver, are moot points enough; but at all events such stories must always be popular both in the nursery and elsewhere. The illustrations are triumphs of artistic excellence.

The Landseer Series of Picture Books. Parts I., II., III., IV. Edinburgh: Nelson and Sons.

If we could praise so heartily and so honestly Nelson's Nursery Series, what higher commendation must we not bestow upon this popular and picturesque glorification of Sir Edwin Landseer, the greater than Snyders of our time! Every one of these parts has the brightest-coloured engravings of best pictures, each worthy of a frame; and issued at a cost which might bring them into cottages. Modern art, especially in the way of oleography, must soon clear away from the humblest hovel-walls the rubbish which has so long been supposed to adorn them; and as a cheap method of popular education, such efforts as these of Nelson and Sons are essentially patriotic.

Won from the Waves; or, the Story of Maiden May. Griffith and Farran.

One of the late Mr. Kingston's graphic sea romances, for which he has long been so deservedly famous, especially with our juveniles. Of course, the foundling of the waves turns out to be a lady of high degree, and makes a great match at the marriage mart in the final chapter; and there is a whole bookful of nautical adventure, love-making, dialogue, and marine literature of a past generation, amply sufficient to satisfy readers who have the time and patience to peruse it thoroughly. The sixteen full-page illustrations are fair pictures of the archaic garb of a hundred years ago, but perhaps might in a sea-story have displayed more of naval incident, the figures being all on shore, and what Jack would call 'landlubbers;' from such a title one would have looked for storms, wrecks, sea-fights, and the like, whereas the artist gives us nothing but cottage interiors, domestic interiors, a wedding procession, and so forth. However, the pretty book will be popular (probably has been popular already this Christmas-tide) with schoolboys longing for the sea and schoolgirls looking out for gallant husbands.

A Wonderful Ghost Story. Griffith and Farran.

This little shilling book is a re-print of 'Mr. H.'s Own Narrative' from *All the Year Round*. It was published

in that magazine twenty years ago, so will be new to the present generation. The story is certainly wonderful, and there seems no reason to doubt its authenticity. There is one weak point in the narrative, however. The ghostly lady sits opposite Mr. Heaphy at dinner, invisible to the rest of the party, but nevertheless eats beef and drinks claret. The unprejudiced mind naturally asks the question, who carved the beef and who poured out the claret?

'Dolly Dear;' or, the Story of a Waxen Beauty. By Mrs. Gellie (M. E. B.). Griffith and Farran.

The little girl who finds among her Christmas gifts a prettily bound book with the above title will read with delight the adventures of the model doll, almost as large as a real baby, who plays so important a part in the lives of her young mistresses, and we venture to say that once begun it will not readily be laid down.

The interest of the tale is well sustained throughout, and it contains many truths and useful lessons which, laid to heart and practised by the reader, may have as good an effect upon her as 'Dolly Dear' herself had upon Eileen and Lizzie when ill in bed.

'St. Aubyn's Laddie,' and the Little Would-be Soldier. By E. C. Phillips. Griffith and Farran.

The little hero of this pathetic tale is Cyril St. Aubyn, always known by his pet name of 'Laddie,' and the would-be soldier is his cousin Alan, who is of the same age as himself, and has such a devoted affection for the little crippled invalid that he even gives up his cherished wish of being a soldier, and promises to remain with Cyril all his life. He is a high-spirited, determined little fellow, and though only seven and a half when he makes this promise, he keeps it faithfully, although at the cost of some tears; and when Cyril a few days before he dies wants to release him from his promise, he refuses, saying, 'No; if you don't want me to write your letters for you, I'll be an army doctor, and cure the sick and wounded soldiers, and be doctor to their wives and children when they are ill. Wouldn't that be nice?'

This satisfies Cyril, and Alan, glad to have made his cousin happy, says he never means to change again.

Cyril himself is a model of patience and thoughtfulness for others, and his influence his felt by all who know him. The story is one which will be read with interest by all who like this style of sorrowful literature.

The Belton Scholarship. By Bernard Heldmann. Griffith and Farran.

A story that will interest boys, treating as it does of school life, and coming from the pen of one already well known to them as a writer of similar tales.

The chief incident of the book is, of course, the competition for the scholarship; but there are many other scenes introduced that boys will appreciate, and in particular the account of the paper chase in Chapters VI. and VII. is very exciting, while the tragic affair of Charlie Stewart and the bull will arouse the sympathy of the reader.

In Belton school, as in other establishments of the kind, there are to be found boys of all tastes and temperaments, good and bad dispositions; for a school is a little world in itself, and the child is father to the man.

George Denton, the hero, is not faultless, but he has many good qualities which are brought out strongly when, by a reverse of fortune, he has to depend on himself, and industry and perseverance take the place of laziness and discouragement at his inability to learn as quickly as his companions. How he succeeds in his efforts, and who in the end wins the Belton, we leave our boy-readers to discover for themselves.

The Baby's Museum. Griffith and Farran.

A perfect collection of the 'rhymes, jingles, and ditties' which have lived and laughed in our nurseries from generation to generation, profusely and humorously illustrated. Quite the book for our little ones, and in the multitudinous woodcuts especially useful to rub out wrinkles from older foreheads.

White's Grammar School Texts. The Epodes and Carmen Sæculare of Horace, with an English Vocabulary. Longmans.

One of the numerous series in Greek and Latin classics issued in the interests of educational literature by Dr. White. A short account of Horatian metres precedes the text, which is followed by a full vocabulary: the whole comprising a most compendious manual for the numerous happy students of these easier times. What would not an old Carthusian or Etonian have given for such a trouble-saving help up Parnassus!

Longmans' Magazine. No. 2. December, 1882. London: Longmans, Green, and Co.

This is an excellent number, and promises well for the future of this new candidate for public favour. Dr. Smiles' 'John Harrison the Chronometer Maker,' and Mr. Froude's 'Norway Fjords,' are alone worth double the price of the magazine. We cordially recommend our readers who have not already seen 'Longmans' Magazine' to get a copy.

A Short Treatise on the Greek Particles, etc. By F. A. Paley, M.A., Editor of the Greek Tragic Poets, and Examiner to the University of London. Deighton, Bell and Co.

A learned, if so-called elementary, handbook for scholars who study the Greek classics microscopically. Mr. Paley is known as a distinguished educationalist, and has contributed several volumes to the series of *Bibliotheca Classica*, published by the eminent firm of George Bell and Co. This treatise is claimed by its author to be 'entirely original,' and he adds that as a concise manual it is probably unique, as explaining correctly the doctrine of the Greek particles. In this connection one cannot help remembering—and quoting—the famous triumph of rhyme and rhythm, *Browning's* 'Grammarian's Funeral,' where it is written—

> 'So, with the throttling hands of Death at strife,
> Ground he at grammar;
> Still, through the rattle, parts of speech were rife;
> While he could stammer
> He settled *Hoti's* business—let it be!
> Properly placed *Oun*—
> Gave us the doctrine of the enclytic *De*,
> Dead from the waist down!'

That Mr. Paley himself has full sympathy with such enthusiasm, let this extract from his preface suffice, viz.:—

'To my mind, then, so far from being a dry, unimportant subject, the combinations of the Greek Particles are full of the highest interest, as being, so to say, an elaborately finished part of a most complex and beautiful machinery. That a few inflected monosyllables should determine so completely the tone and meaning of a sentence is in itself a curious phenomenon of language. Believing that, from long and careful observation, I understand them myself, I have tried to make others do the same; and I only hope they will have the same pleasure in reading which I have had in writing this small work.'

Ivanhoe. Edition de Luxe. Part I. Ward and Lock.

This, perhaps the romance-masterpiece of Sir Walter Scott, is here so splendidly printed and so spiritedly illustrated as to be indeed what it professes, a luxury of literature. The excellence of the ancient matter 'goes without saying,' and the profuse modern embellishments by several French and English artists are worthy of the

text. The whole novel is to be issued in ten parts at a shilling, and it is hoped will amply recompense the enterprising 'House of Warwick,' now transferred to Salisbury Square.

Christmas and New Year's Cards. London: M. Ward and Co.

We have received from Messrs. Marcus Ward and Co. an excellent assortment of seasonable cards.

Songs for Little Singers. Composed by Henry King Lewis. Hodder and Stoughton.

'Songs for Little Singers' is a book of words and music well expressed by such a title. The words comprise forty-four selected hymns and pretty rhymes, mostly by well-known authors, and the musical settings to them, all composed by Mr. Lewis, are simple and tasteful if not very scientific. Those which please us most are 'His Little Child,' 'Thy Kingdom Come,' 'Benediction,' 'Little Things,' and 'Alice's Supper.' Some of the airs are more original than others, but, on the whole, we can heartily recommend this pretty book as supplying a want that has long been felt in giving the children songs to sing which they can understand and enjoy, and which express the real feelings of childhood.

The Teachers' Diary and Pocket Book. London: Jarrold and Sons.

Many a hard-worked teacher will thank the Messrs. Jarrold for the timely issue of this admirable, and, we might add, much-needed volume. If regularly used, it will save no end of trouble and worry. Its comprehensiveness may be gathered from the fact that it is adapted to the wants of either master, mistress, or pupil-teacher.

'The head master, by using it, will have always at hand any information he may require, without having to turn first to one page and then to another of the Code and the Instructions to Inspectors; all the information bearing on the same subject being put together.

'He will also find useful the form on which to enter the time table for each standard; and the space for observations on the work of the standard, results of his examinations, etc., during the year.

'The head mistress, in addition to the above, will find the needlework requirements for each standard, together with the exercises that may be set on the day of examination.

'The Assistant or Pupil Teacher will find in it:—

(*a*) The *work of his class* set out, whatever standard he may be taking;

(*b*) Information from the "Circular to Inspectors," as to *what will secure a pass* in each subject;

(*c*) A form on which to enter the *time table of his class;*

(*d*) A space for entering *notes on the work of his class;* and (if a pupil-teacher),

(*e*) A full statement of *what* he has *to study* in each subject *for his own examination*, not only for the year, but right up to the time when he goes to the Training College.'

We heartily recommend 'The Teachers' Diary and Pocket Book' to every elementary teacher in the country.

[Several Reviews are unavoidably left over for want of space.]

Publications Received.

Christmas Cards—
(1) Marcus Ward's Christmas Cards. Marcus Ward and Co.

Classics—
(1) Horace. Epodes and Carmen Seculare (White's Grammar School Texts). Longmans.

Diagrams—
(1) Johnston's Standard Series of School Diagrams. No. 1. Chemical Apparatus, mounted on rollers. A. Johnston.
(2) Johnston's Illustrations of Natural Philosophy. Sheets No. 7 and 7½ with Handbooks. A. Johnston.

English Grammar—
(1) Hickey's Graduated Exercises in English Grammar. For Standard VI. John Heywood.
(2) Blackie's English Grammar. Standards 2, 3, 4, 5, 6, and 7. Blackie and Son.

Euclid—
(1) Nop's Class Lessons on Euclid. Books 1 and 2. Kegan Paul and Co.

Geography—
(1) Spence's Geography: 'Civil Service Series.' Crosby, Lockwood and Co.

German—
(1) Wortfolge, or Rules and Exercises on the Order of Words in German Sentences with Vocabulary. G. Bell and Co.

History—
(1) Stories from English History for Standard III. Gall and Inglis.
(2) History of England. Part I. for Standard IV. Gall and Inglis.

Latin—
(1) Introduction to Latin Prose Composition. By R. M. Milington. Longmans.

Literature—
(1) Shakespeare's Julius Cæsar. Longmans.
(2) Selections from Julius Cæsar. Longmans.

Mechanics—
(1) Garnett's Elementary Mechanics. G. Bell and Sons.
(2) Besant's Hydro-Mechanics. G. Bell and Sons.

Mensuration—
(1) My First Mensuration. By M. H. Senior. Greenwell.

Miscellaneous—
(1) Heroes of Maritime Discovery. Gall and Inglis.
(2) The Belton Scholarship. Nelson and Sons.
(3) Tommy Greedygrab and Wriggletum. John Heywood.
(4) Universal Instructor. Vol. II. Ward, Lock, and Co.
(5) Our Dolly. Griffith and Farran.
(6) St. Aubyn's Laddie. Griffith and Farran.
(7) Won from the Waves. Griffith and Farran.
(8) The Teachers' Diary and Pocket Book. Jarrold and Sons.
(9) Four Little Mischiefs. Blackie and Son.
(10) Naughty Miss Bunny. Blackie and Son.
(11) Stories of Old Renown. Blackie and Son.
(12) A Wonderful Ghost Story. Griffith and Farran.
(13) Two Bible Cartoons. Wesleyan Methodist Sunday School Union.
(14) Two Illustrated Readings. Wesleyan Methodist Sunday School Union.
(15) Philip Phillips' Story of His Life. Wesleyan Methodist Sunday School Union.
(16) School-Room Placard. No. 1. Wesleyan Methodist Sunday School Union.
(17) Wesleyan Sunday School Magazine. Vol. 1882. Wesleyan Methodist Sunday School Union.
(18) Scholars' Tablet Book for 1883. Wesleyan Methodist Sunday School Union.
(19) Our Boys and Girls. Vol. 1882. Wesleyan Methodist Sunday School Union.
(20) True Stories of Foreign History. Blackie and Son.

New Code—
(1) Handbook of the New Code. By J. F. Moss. Isbister.

Periodicals and Magazines—
(1) Longmans' Magazine. No. 2. Longmans.
(2) Weldon's Ladies' Journal. Christmas Double Number. Weldon and Co.
(3) Book of Sports and Pastimes. Part IX. Cassell and Co.
(4) Our Little Ones. Vol. III. No. 2. Griffith and Farran.
(5) Universal Instructor. Part XXVI. Ward, Lock, and Co.
(6) Edition de Luxe of the Waverley Novels. 'Ivanhoe.' Ward, Lock, and Co.
(7) Gage's School Examiner and Student's Assistant. Gage and Co.

Readers—
(1) 'Longmans' Modern Series' Illustrated Reader Primer. Longmans.
(2) History Readers. No. 1. Marcus Ward and Co.

Test Cards—
(1) Greenwell's Test Cards. A. B. C. Greenwell.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month,* or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. AMEY JONEY.—If a person buy pins when they are 18 in a row, and sell them 11 in a row at the same price, how much is the gain per cent. on the outlay?

11 : 100 :: 7 : Gain per cent.
$= \frac{700}{11}$
$= 63\frac{7}{11}$ per cent. Ans.

2. CHOKRA.—A reduction of 30 per cent. in the price of eggs would enable a purchaser to obtain 54 more for a guinea. What may the present price be?

$$\underset{7\not0}{£} : \underset{3}{s.} :: \underset{10\not0}{£} : \text{Present price of the eggs that would be obtained for a guinea after reduction}$$

= 30s.
∴ Present price = 54 for (30s. − 21s.)
= 54 for 9s.
= 6 for 1s.
= 2d. each. Ans.

3. ROMEO.—Find the G. C. M. and L. C. M. of $3\frac{1}{2}$, $4\frac{1}{4}$, $6\frac{1}{8}$, and $8\frac{3}{4}$.

$= \frac{14}{8}, \frac{34}{8}, \frac{49}{8}, \frac{35}{8}$;

G. C. M. of numerators = 1
L. C. M. ,, denominators = 120
∴ G. C. M. = $\frac{1}{120}$. Ans.
L. C. M. of numerators = 19,600
G. C. M. ,, denominators = 1
∴ L. C. M. = $\frac{19600}{1}$
= 19,600. Ans.

4. STUDENT.—Simplify

$$\left(\frac{1+01}{1-01}-\frac{1-01}{1+01}+\frac{0004}{1-00001}\right)\times\left(\frac{1+01}{02}\right),$$

the answer to be given as a vulgar fraction. (*Kirk's* 'Arithmetic for Pupil Teachers.)

$$\left(\frac{1+01}{1-01}-\frac{1-01}{1+01}+\frac{0004}{1-00001}\right)\times\left(\frac{1+01}{02}\right)$$
$$=\left(\frac{11}{09}-\frac{09}{11}+\frac{0004}{09999}\right)\times\frac{11}{02}$$
$$=\left(\frac{1}{9}-\frac{9}{11}+\frac{40}{9999}\right)\times\frac{11}{2}$$
$$=\frac{12221-8181+40}{9999}\times\frac{11}{2}$$
$$=\frac{12261-8181}{9999}\times\frac{11}{2}$$
$$=\frac{680}{\not303\not0}\times\frac{\not11}{\not2}$$
$$=\frac{680}{909}$$
$$=2\frac{74}{909}.$$ Ans.

5. T. H. B.—If I invest in 3 per cents. at 72, and on their rising to 80 sell out and invest the proceeds in a 4 per cent. stock at 96, thereby increasing my income £43 10s., find the sum at first invested.

Income on an investment of £72 in 1st case = £3;
,, this ,, on transferring
$$= £\not4 \times \frac{10}{\not96}$$
$$= £3\tfrac{1}{3};$$
Increase in income on this investment = $£3\frac{1}{3} - £3$
$= £\frac{1}{3}$;
∴ Sum invested = $£72 \times \frac{43\frac{1}{3}}{\frac{1}{3}}$
$= £\left(\frac{36}{\not72} \times \frac{261}{\not2}\right)$
$= £9396.$

6. A. T.—Distribute £17 amongst 13 persons, so that the persons being taken in order, each after the first may receive 2s. 6d. more than the person immediately preceding him; also find how much money will remain, for want of a coin of less value than a farthing.

2s. 6d. × (12+11+10+9+8+7+6+5+4+3+2+1)
= 2s. 6d. × 78
= £9 15s.;
(£17 − £9 15s.) ÷ 13
= £7 5s. ÷ 13
= 11s. $1\frac{8}{13}$d.
∴ Shares = 11s. $1\frac{8}{13}$d., 13s. $7\frac{5}{13}$d., 16s. $1\frac{2}{13}$d., 18s. $7\frac{10}{13}$d., £1 1s. $1\frac{7}{13}$d., £1 3s. $7\frac{5}{13}$d., £1 6s. $1\frac{3}{13}$d., £1 8s. $7\frac{1}{13}$d., £1 11s. $1\frac{11}{13}$d., £1 13s. $7\frac{9}{13}$d., £1 16s. $1\frac{4}{13}$d., £1 18s. $7\frac{12}{13}$d., and £2 1s. $1\frac{6}{13}$d.
Amount remaining = 5 farthings = $1\frac{1}{4}$d.

7. HENRY.—Divide £16,984 among A, B, C, and D, so that A's share : B's share :: 6 : 5, B's share : C's share :: 2 : 3, and C's share : D's share :: 4 : 3. (*Barnard Smith.*)

B's share = $\frac{5}{6}$ of A's;
C's ,, = $\frac{2}{3}$ of B's
= $\frac{2}{3}$ of $\frac{5}{6}$ of A's
= $\frac{5}{9}$ of A's;
D's ,, = $\frac{4}{3}$ of C's
= $\frac{4}{3}$ of $\frac{5}{9}$ of A's
= $\frac{20}{27}$ of A's;
∴ A's share = £16,984 ÷ $(1+\frac{5}{6}+\frac{5}{9}+\frac{20}{27})$.
= £16,984 ÷ $\frac{98}{27}$
= £(88 × 48)
= £4224;
B's share = $\frac{5}{6}$ of £4224 = £3520;
C's ,, = $\frac{5}{9}$,, = £5280;
D's ,, = $\frac{20}{27}$,, = £3960.

8. PUZZLED.—A tradesman has on his books 960 customers, whose monthly custom averages in each case £5; he sends out his bills at the close of each month and allows 5 per cent. discount to each who pays ready money, but charges 2½ per cent. interest for each complete calendar month for all outstanding bills; at the end of a certain month one-half of these bills have been outstanding for one month, one-third for two, and the rest for three months; find the ratio of ready-money customers to the others, if the discount paid to them is equal to the interest charged to the others. (Certificate, 1880.)

Discount on ready-money payments = $\frac{1}{20}$ of (£5 × No. of ready-money customers);
Interest on outstanding bills for 3rd month
= $\frac{1}{40}$ of (£5 × $\frac{1}{2}$ No. of other customers)
+ $\frac{1}{60}$ of (£5 × $\frac{1}{3}$,, ,, ,, ,,)
+ $\frac{1}{80}$ of (£5 × $\frac{1}{4}$,, ,, ,, ,,);
Interest on outstanding bills for 2nd month
= $\frac{1}{40}$ of (£5 × $\frac{1}{3}$ No. of other customers)
+ $\frac{1}{60}$ of (£5 × $\frac{1}{3}$,, ,, ,, ,,);
Interest on outstanding bills for 1st month
= $\frac{1}{40}$ of (£5 × $\frac{1}{2}$ No. of other customers);
∴ Total interest on outstanding bills
= $\frac{3}{40}$ of (£5 × $\frac{1}{2}$ No. of other customers)
+ $\frac{1}{20}$ of (£5 × $\frac{1}{3}$ No. of other customers)
+ $\frac{3}{40}$ of (£5 × $\frac{1}{4}$ No. of other customers)
= £5 × $\left\{(\frac{3}{40}\text{ of }\frac{1}{2})+(\frac{1}{20}\text{ of }\frac{1}{3})+\left(\frac{7}{40}\text{ of }\frac{1}{\frac{9}{2}}\right)\right\}$ of No. of other customers
= £5 × $(\frac{3}{80}+\frac{1}{60}+\frac{1}{80})$ of No. of other customers
= £5 × $\frac{1}{12}$ No. of other customers;
∴ £5 × $\frac{1}{20}$ No. of ready-money customers
= £5 × $\frac{1}{12}$ No. of other customers;
∴ No. of ready-money customers : No. of other customers
:: $\frac{1}{12}$: $\frac{1}{20}$
:: 5 : 3.

9. SNOWDROP.—Find the value of $13\cdot2\dot{7}\dot{5}$ of 2 ac. 3 ro.

$13\cdot2\dot{7}\dot{5}=13\frac{275-2}{990}=13\frac{273}{990}=13\frac{91}{330}$;
2 ac. 3 ro. × 13 = 35 ac. 3 ro.;
2 ac. 3 ro. × $\frac{91}{330}$ = 250 ac. 1 ro. ÷ 330
= 3 ro. 1 po. 10 yds. 108 in.
∴ Value = 35 ac. 3 ro. + 3 ro. 1 po. 10 yds. 108 in.
= 36 ac. 2 ro. 1 po. 10 yds. 108 in. Ans.

10. GRACIE.—A cistern can be filled by two pipes, A and B, in 4 minutes and 5 minutes respectively, and emptied by C in 2½ minutes. A is opened for 2 minutes, and then A and B together for one minute more, when C is also opened. In what time would the cistern which now contains 361 gallons be full, and how many gallons would have passed through A and B respectively?

Part filled by A in 2 minutes = $\frac{1}{4}\times 2=\frac{1}{2}$,
,, ,, ,, A and B in 1 minute = $\frac{1}{4}+\frac{1}{5}=\frac{9}{20}$,
∴ ,, ,, in the 3 minutes = $\frac{1}{2}+\frac{9}{20}=\frac{19}{20}$,
Part remaining to be filled = $\frac{1}{20}$;
Part emptied by C in 1 minute = $\frac{1}{2\frac{1}{2}}=\frac{2}{5}$,
,, filled in one minute when all are open
= $\frac{9}{20}-\frac{2}{5}=\frac{27-25}{60}=\frac{1}{30}$,
∴ The cistern will be full in $(\frac{1}{20}\div\frac{1}{30})$ min.
= $\frac{3}{2}$ min.
= 1½ min. Ans.

The cistern holds $(361\times\frac{2}{19})$ gallons
= 380 gallons;
∴ Quantity passed through A = $\left(380\times\frac{4\frac{1}{2}}{4}\right)$ gals.
= $\frac{95\times 9}{2}$ gals.
= 472½ gals. Ans.
,, ,, ,, B = $\left(380\times\frac{2\frac{1}{2}}{5}\right)$ gals.
= 190 gals. Ans.

11. NO NAME.—There are two vessels, one containing 12 gallons of water, and the other 6 gallons of wine; if a gallon be taken out of each, and poured into the other, and if this be repeated 4 times, find how much water and wine will be in each? (*Johnstone's* 'Arithmetic).

After first exchange—
First contains 11 gals. of water, and 1 gal. of wine,
Second ,, 5 ,, ,, wine, ,, 1 ,, ,, water:
After second exchange—
First contains $(11-1\frac{1}{6}+\frac{1}{6})$ gals. of water, and $(1-\frac{1}{6}+\frac{1}{6})$ gals. of wine,
,, ,, 10½ gals. of water, and 1½ gals. of wine,
Second ,, 4½ ,, ,, wine, ,, 1½ ,, ,, water:
After third exchange—
First contains $(10\frac{1}{2}-\frac{4}{7}\frac{1}{8}+\frac{7}{24})$ gals. of water, and $(1\frac{3}{4}-\frac{7}{24}+\frac{1}{24})$ gals. of wine,
,, ,, $9\frac{11}{16}$ gals. of water, and $2\frac{5}{16}$ gals. of wine,
Second ,, $3\frac{13}{16}$,, ,, wine, ,, $2\frac{5}{16}$,, ,, water:
After fourth exchange—
First contains $(9\frac{11}{16}-\frac{15}{77}\frac{5}{8}+\frac{87}{352})$ gals. of water, and $(2\frac{5}{16}-\frac{87}{352}+\frac{25}{88})$ gals. of wine,
,, ,, $9\frac{17}{22}$ gals. of water, and $2\frac{7}{22}$ gals. of wine.
Second ,, $3\frac{15}{22}$,, ,, wine, ,, $2\frac{7}{22}$,, ,, water.

12. F.S.—If the three per cent. consols are at 81⅛, what must be the price of the five per cents., that there may be no loss of income in selling out of the former, and reinvesting in the latter, allowing for the usual brokerage of ⅛ per cent. of stock on each transaction? (*Civil Service Examination for Excise, Nov.*, 1880.)

£ £ £
3 : 5 :: 81¼ : Price of stock with brokerage.

5
3 | 408¾
£136¼

∴ Price of the five per cents. = £136¼ − £⅛
= £136 Ans.

13. ANXIOUS.—The price of £100 bank stock which pays 6½ per cent. is 185¾. £6,250 of this stock is transferred to the three per cent. consols at 92⅞; find the alteration in income.

Interest on Bank stock = £(62½ × 6¼)
= £406 5s.;
Amount of stock in consols = £$\left(6{,}250\times\frac{185\frac{3}{4}}{92\frac{7}{8}}\right)$
= £(6,250 × 2)
= £12,500;
Interest on consols = £(125 × 3)
= £375;
∴ Alteration in income = £(406 5s. − £375) decrease
= £31 5s. decrease. Ans.

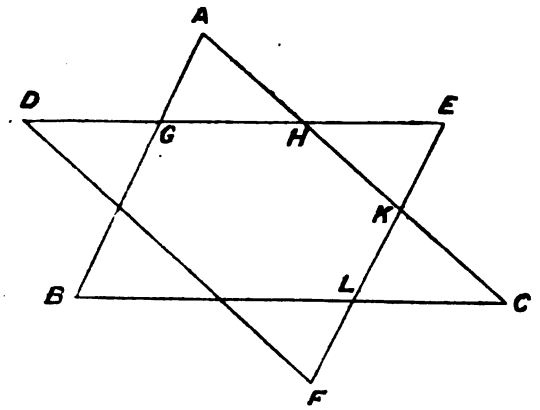
NOTE.—Writing pretty fair, but too thick.

14. KAPPA.—Two settlers in New Zealand own adjoining farms of 3,000 and 5,000 acres respectively. They unite their farms, taking at the same time an additional partner, who pays them £8,000, on the understanding that a third share of the land shall in future belong to each. How is the £8,000 to be divided between the original owners?

Size of each farm after division = $\frac{3000+5000}{3}$ acres
= 2,666⅔ acres;
∴ Value of an acre = £8,000 ÷ 2,666⅔
= £3;
Quantity taken from first settler = (3,000 − 2,666⅔) acres
= 333⅓ acres;
∴ First settler should receive (333⅓ × 3) £
= £1,000,
And second ,, ,, ,, £7,000.

Geometry.

1. CONSERVATIVE.—If the sides of a triangle be trisected, and lines be drawn through the points of section adjacent to each angle, so as to form another triangle, this shall be in all respects equal to the first.



Let ABC be the given triangle, and let the triangle DEF be formed by drawing lines through the points of trisection of the sides adjacent to the angles.

Then the triangle DEF shall be equal in all respects to the triangle ABC.

Proof.—Because GB is double of AG,
∴ triangle GHB is double of triangle AHG;
similarly, triangle HGG is double of triangle AHG;
∴ triangle GHB is equal to triangle HGC;
wherefore GH is parallel to BC. (I. 39.)

Therefore the triangles DEF has its sides respectively parallel to the sides of the triangle ABC.

In the triangles AHG, KHE,
the angles HAG, AGH = angles HKE, KEH, each to each, (I. 29.)
and side AH = side KH,
∴ side AG = side KE; (I. 26.)
similarly, it can be proved that LK = KE, and FL = LK;
∴ EF is treble of EK, and therefore equal to AB.
Similarly, it can be proved that DE = BC, and DF = AC.
∴ Triangle DEF is equal to triangle ABC in all respects.
Q. E. D.

2. INQUISITIVE.—(1) Deduce from Euclid II. 11, that $AB^2 + BH^2 = 3AH^2$.

(2) If m and n are any numbers, and lines be taken whose lengths are m^2+n^2, m^2-n^2, and $2mn$ units respectively, show that these lines form a right-angled triangle.

(1) $AB^2 = AH^2 + BH^2 + 2AH.BH$ (II. 4.)
$AB^2 + BH^2 = AH^2 + 2BH^2 + 2AH.BH$ (Ax. 2.)
$= AH^2 + 2(BH^2 + AH.BH)$
$= AH^2 + 2AB.BH$ (II. 3.)
$= AH^2 + 2AH^2$ (II. 11.)
$= 3AH^2$. Q. E. D.

2. $(m^2-n^2)^2 + (2mn)^2 = m^4 - 2m^2n^2 + n^4 + 4m^2n^2$
$= m^4 + 2m^2n^2 + n^4$
$= (m^2+n^2)^2$.

As the square of m^2+n^2 is equal to the sum of the squares of m^2-n^2 and $2mn$, the lines representing those units will therefore form a right-angled triangle. (I. 47.) Q. E. D.

3. EGS.—Given two points, find two other points that shall be at the same given distance from each of them. What is the least possible length of the given distance? (Scholarship, 1876.)

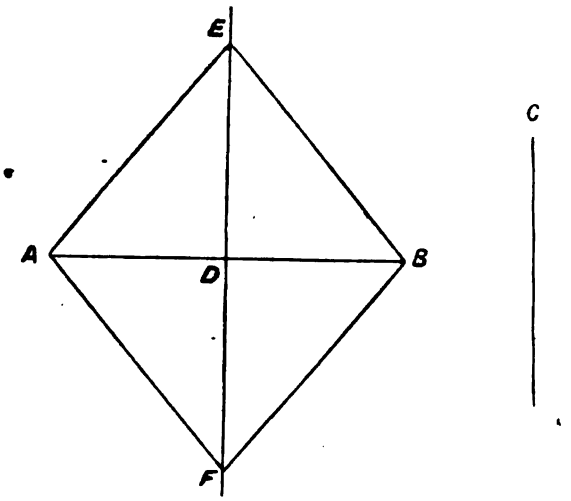
Let A, B be the two given points, and C the given distance.

Join A B, and bisect it in D. (I. 10.)

Draw EDF at right angles to AB. (I. 11.) From A as centre with C as radius cut EF in E and F, then E, F shall be the two points required.

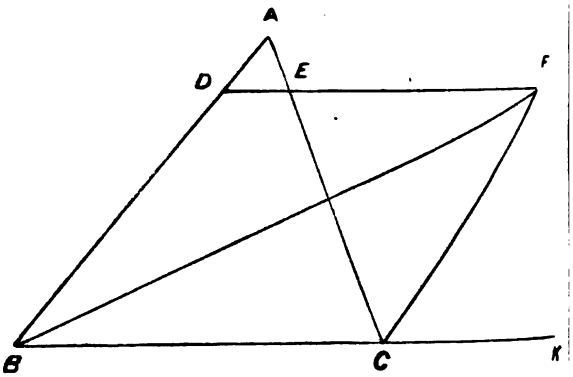
Join A E, B E, A F, B F.

Proof.—In the triangles ADE, BDE,
the two sides AD, DE = the two sides BD, DE, each to each,
and the angle ADE = the angle BDE, (Ax 11)
therefore AE = BE; (I. 4.)
Similarly it can be proved that AF = BF;
and AE, AF = the given distance C, (Def. 15.)
Therefore E, F are the two points required. Q. E. F.



The least possible length of the given distance is half the line joining the two given points, and then the two points coincide.

4. PUZZLER PERPLEXED.—Draw a line DE parallel to the base BC of a triangle ABC, so that DE is equal to the difference of BD and CE.

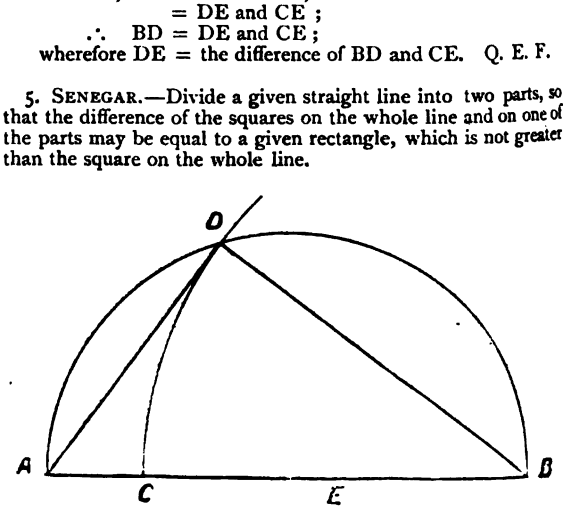


Produce BC to K. Bisect angles ABC, ACK by BF, CF (I. 9) meeting in F. Through F draw FED parallel to BC. (I. 31.)

Then DE shall be equal to the difference of BD, CE.

Proof.—The angle DBF = the angle CBF, (Con.)
and the angle CBF = the angle BFD, (I. 29.)
∴ the angle DBF = the angle BFD (Ax. 1);
wherefore BD = DF; (I. 6.)
Similarly it can be proved that CE = EF.
Now, DF = DE and EF,
= DE and CE;
∴ BD = DE and CE;
wherefore DE = the difference of BD and CE. Q. E. F.

5. SENEGAR.—Divide a given straight line into two parts, so that the difference of the squares on the whole line and on one of the parts may be equal to a given rectangle, which is not greater than the square on the whole line.



Let AB be the given straight line. Describe a square equal to the given rectangle (I. 14.), and make BC equal to the side of the square.

Upon AB describe the semicircle ADB.

From B as centre with BC as radius cut this semicircle in D. Join BD, AD, and make AE equal to AD.

Then the difference of the squares on AB, AE is equal to the square on BC, that is, the given rectangle.

Proof.—The angle ADB is a right angle (III 3);
therefore square on AB = squares on BD, AD (I. 47)
= squares on BC, AE;
wherefore square on BC = difference of squares on AB, AE (Ax. 3.)

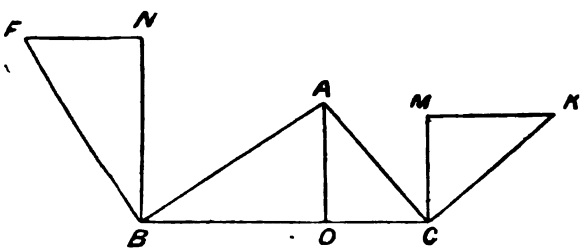
Therefore AB is divided in the point E, so that the difference of the squares on AB, AE is equal to the given rectangle.

Q. E. F.

6. M. McN. G.—In the figure of Euclid I. 2, if the diameter of the smaller circle is the radius of the larger, show where the given point and the vertex of the constructed triangle will be situated. (*Todhunter.*)

In this case, the given point and the vertex of the triangle will be situated on the circumference of the smaller circle.

7. MATHEMATICS.—If, in the figure to Euclid I. 47, DB be produced to meet a perpendicular from F in N, and EC to meet a perpendicular from K in M, and if AL meet BC in O, prove that FN and KM are each equal to AO, that BN is equal to BO, and CM to CO; also that the two triangles BNF and CMK are together equal to the triangle ABC.



Proof.—The angle ABF = the angle OBN, (Ax. 11.)
∴ the angle NBF = the angle ABO; (Ax. 3.)
wherefore in the triangles BNF, AOB,
the angles BNF, NBF = the angles AOB, ABO, each by each,
and the side BF = the side AB,
∴ therefore the triangles are equal in all respects; (I. 26.)
wherefore FN = AO, and BN = BO,
also triangle BNF = triangle AOB.
Similarly it can be proved that KM = AO, GM = CO, and triangle CMK = triangle AOC.
Again, triangle BNF = triangle AOB,
and triangle CMK = triangle AOC,
∴ triangles BNF, CMK together = triangle ABC. (Ax. 2.)

Q. E. D.

Algebra.

1. FRONT-DE-BŒUF, Leamington.—Find the sum of the pyramidal numbers 1, 4, 10, 20, 35,.....to n terms.

The following series form what are called the different orders of *figurate numbers*:

1st order, 1, 1, 1, 1, 1,.....
2nd ,, 1, 2, 3, 4, 5,.....
3rd ,, 1, 3, 6, 10, 15,.....
4th ,, 1, 4, 10, 20, 35, ...
.....

The general law is, that the n^{th} term of any order is the sum of n terms of the preceding order. Thus the n^{th} term of the second order is n, of the third order is $\frac{n(n+1)}{1\cdot 2}$, of the fourth order is $\frac{n(n+1)(n+2)}{1\cdot 2\cdot 3}$, and generally the n^{th} term of the r^{th} order is $\frac{n(n+1).....(n+r-2)}{\lfloor r-1}$.

∴ Sum of r^{th} order to n terms $= \frac{n(n+1)(n+2).....(n+r-1)}{\lfloor r}$;

Hence sum of the series 1, 4, 10,.....to n terms

$$= \frac{n(n+1)(n+2)(n+4-1)}{\lfloor 4}$$
$$= \underline{\tfrac{1}{24}\, n(n+1)(n+2)(n+3).}$$

Mensuration.

1. J. EDWARDS, Burton-on-Trent.—Find, in gallons, by Hutton's general rule, the volume of a cask, length 46·9 in., bung diameter 30·6 in., head diameter 26·1 in. Also find, in gallons, the wet ullage of a standing cask, length 30½ in., bung diameter 27¼ in., head diameter 23 in., wet ullage 10 in. (*Excise Exam.*, May, 1882.)

Dr. Hutton's general rule for finding the volume of a cask:—Add into one sum 39 times the square of the bung diameter, 25 times the square of the head diameter, and 26 times the product of the two diameters; then multiply this sum by the length, and the product again by ·0003131 for the content in gallons. (The dimensions of the cask must be expressed in inches.)

$(30\cdot6)^2 \times 39 = 36,518\,04$
$(26\cdot1)^2 \times 25 = 17,030\cdot25$
$30\cdot6 \times 26\cdot1 \times 26 = 20,765\cdot16$
$74,313\cdot45$
$46\ 9$
66882105
44588070
29725380
$3485300\cdot805$
$\cdot 0003131\frac{1}{2}$
3485300805
10455902415
154902258
$109\cdot593347535$
$= \underline{109\cdot59 \text{ gals. Ans.}}$

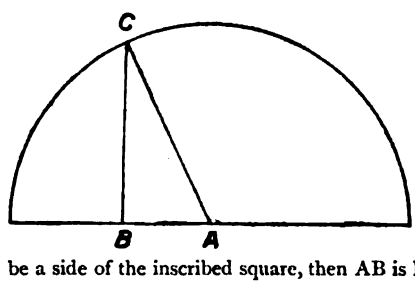
$30\frac{1}{2}$ in. $- 10$ in. $= 20\frac{1}{2}$ in.

Mean diameter of occupied portion $= 27\frac{1}{4} - \frac{(20\frac{1}{2})^2 \times (27\frac{1}{4} - 23)}{(30\frac{1}{2})^2}$

$= 27\frac{1}{4} - \frac{\frac{1681}{4} \times \frac{17}{4}}{\frac{3721}{4}}$
$= \frac{109}{4} - \frac{28577}{14884}$
$= \frac{405589 - 28577}{14884}$
$= \frac{377012}{14884}$
$= \frac{94253}{3721}$;

Wet ullage $= (\frac{94253}{3721})^2 \times 10 \times \cdot 0028326$
$= \frac{8885888009}{13845841} \times \cdot 028326$
$= \frac{251637646\cdot 982934}{13845841}$
$= \underline{18\cdot 17 \text{ gals. Ans.}}$

2. PICKWICK.—Find the side of a square inscribed in a semicircle, whose radius is 5 feet.



If BC be a side of the inscribed square, then AB is half a side of the square.

$CB^2 + BA^2 = AC^2$ (I. 47.)
$CB^2 + (\frac{1}{2}\, CB)^2 = 5^2$
$CB^2 + \frac{1}{4}\, CB^2 = 25$
$\frac{5}{4}\, CB^2 = 25$
$CB^2 = \frac{4}{5}$ of 25
$= 20$
$\therefore \underline{CB = \sqrt{20}}$

∴ Side of inscribed square $= 2\sqrt{5}$ ft., or
$\underline{4\cdot 472...}$ ft. Ans.

3. ALASCO.—A mirror measuring 33 inches by 22 is to have a frame of uniform width, whose area is to be equal to that of the glass. Find the width.

Area of frame = [{2(33+22) + 4 times width} × width] square inches;

$\therefore$ (110 + 4 times width) × width = × 33 × 22

4 times width^2 + 110 times width = 726

Width^2 + $\frac{55}{2}$ times width = $\frac{363}{2}$

Completing the square: Width^2 + $\frac{55}{2}$ times width + $(\frac{55}{4})^2$ = $\frac{363}{2} + \frac{3025}{16}$

$= \frac{2904 + 3025}{16}$

$= \frac{5929}{16}$

Extracting square root: Width + $\frac{55}{4} = \frac{77}{4}$

$\therefore$ Width = $\frac{77}{4} - \frac{55}{4}$

$= 5\frac{1}{2}$

$\therefore$ Width of frame = $5\frac{1}{2}$ inches.

4. J. N.—Find the area of a segment whose arc contains 245 degrees 45 minutes; the diameter of the circle being 48 ft. 9 in. (*Nesbit's* 'Mensuration.')

ft.

48·75

48·75

24375

34125

39000

19500

2376·5625

·7854

95062500

118828125

190125000

166359375

Deg. deg.

360 : 245¾ :: ////////// : Area of Sector.

4 4

//// 983 20·73946875

16 983

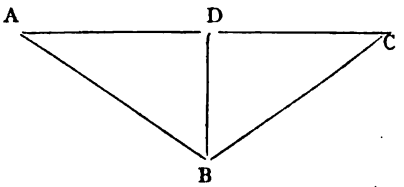
6221840625

16591575000

18665521875

16)20386·89778125

1,274·181111328125 sq. ft.



$\angle ABC = 360° - 245\frac{3}{4}° = 114\frac{1}{4}°$,

$\angle ABD = 57\frac{1}{8}°$.

$\frac{AD}{AB} = \sin ABD = \sin 57\frac{1}{8}° = \cdot 8398567$,

$\frac{BD}{AB} = \cos ABD = \cos 57\frac{1}{8}° = \cdot 5428081$;

$\therefore$ AD = ($\cdot 8398567 \times 24\frac{3}{8}$) ft.

= 20·471507 ft.,

BD = ($\cdot 5428081 \times 24\frac{3}{8}$) ft.

= 13·2309474 ft.

Area of $\triangle ABC$ = AD × BD

= 13·2309474

20·471507

926166318

6615473700

132309474

926166318

529237896

2646189480

270·8574323157318 sq. ft.

$\therefore$ Area of segment = (1,274·181111328125

+ 270·8574323157318) sq. ft.

= 1,545·038543643856 8 sq ft.

[Owing to the pressure on our space by 'Reviews' and 'Advertisements,' we sincerely regret to have to hold over a large number of queries in type.]

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Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

BY ALFRED CARPENTER, M.D. (LOND.), C.S.S. (CAMB.),
Vice-President of the British Medical Association.

XII.

DISLOCATIONS.

DISLOCATIONS are terms which are applied to displacements of the bones which go to form a joint when the natural position of a bone to its fellow is altered, and the joint between them rendered useless. They may be simple, as when there is no other damage than a more or less severe rupture of the surrounding ligaments (as the bands which connect them together are called), or they may be associated with fracture of some of the bony structures which enter into the formation of the joint.

A dislocation is said to be *complete* when the end of the bone is altogether separated from its fellow which made up the joint. It is *incomplete* when it is a partial dislocation only. Dislocations are of very frequent occurrence amongst schoolboys. They are generally caused by sudden falls or severe blows, so that the force of a muscle or the direction of the blow is suddenly brought to bear upon the head of the bone, deflecting it in a direction in which there is not sufficient strength in the envelopes to resist the force. The head of the bone is in consequence forced out of its socket or resting-place. They are simple when there is no injury inflicted upon the surrounding skin or muscles. They are compound when the integuments are torn, and there is blood effused externally through an open wound. They may be associated with fracture, the bone itself being broken either in its shaft or immediately into the joint: these latter, when compound—that is, when the interior of the joint communicates with the external air—are always of most serious consequence.

There are some general symptoms which belong to all dislocations, such as pain more or less severe, according to the extent of the luxation, the injury to the soft parts, and the sensitiveness of the patient. The limb cannot be moved, or if it is moveable it is very painful to move it. There is a depression in one place and an unusual lump in another. The position of the limb is different to that which is natural to it when at rest. It should always be remembered that dislocations are more common among children as a result of a particular fall or injury. A similar fall or injury is more likely to be accompanied by fracture in old people. This arises from the fact that the bones are more brittle in age than in youth. They have more of the lime salts and fatty matter in their composition, with less gelatine, whilst the opposite holds among the young. Dislocations occur most frequently in the following order:—*The Shoulder; the Wrist, Fingers, and Thumb; the Ankle; the Elbow; the Collar-bone; the Hip; the Knee and Knee-cap; the Jaw.* There are some minor forms which are very infrequent, and some more serious, as when a vertebra, or one of the bones of the neck or back, is displaced. In the latter case it is usually accompanied by immediate death, and need not be considered here. The treatment in all kinds of dislocation is more or less similar in some of their parts, so that a few general directions may be given. The cardinal line is that all dislocations should be reduced as quickly as possible. A luxation which has existed five minutes only is a trifle compared with a similar case in which the dislocation has been unreduced for twelve hours. Every hour during which the bone remains out of place increases the mischief; inflammation arises, and with it a tendency to spasm, and to tension in the surrounding muscles. Reduce the dislocation if possible before the patient recovers from the shock of the accident; it is an easy thing to do if done at once; it becomes very serious if it be left for some time unreduced. The reduction may be effected by any one if it is recognised immediately and the right course adopted: but if left until to-morrow, it is only the surgeon who will be likely to recognise it or able to reduce it.

Dislocation of the Shoulder.—This may take place in three different directions. The head of the bone may be thrust forward upon the chest, or backward on the shoulder-blade, or downwards into the arm-pit. The elbow cannot be brought close to the side without very severe pain. There is a cavity where the roundness of the shoulder should be, and the outline is too square. If the head of the bone is forward, it will be felt as a lump on the front of the ribs; or, if backward, upon the shoulder-blade, the head is felt as a ball upon the bone, or it may have disappeared into the arm-pit. This latter is the most painful form, for the head of

the bone is pressing upon the nerves and blood-vessels which supply the limb. These dislocations are easily distinguished in the thin boy, but not always so in the muscular or fat boy. If the dislocation is recognised at once, any one may easily reduce it by placing the patient in the recumbent position on the ground, then pulling off his boot, sitting by the side of the patient on the side which is injured, and placing the foot in the arm-pit, and forcibly pulling at the elbow downwards with both hands towards the feet of the patient. The head of the bone will go into its socket with a snap, and the patient will be comparatively comfortable at once. If this is effected immediately after the accident, there is no occasion for the jack-towel or other ligatures which are suggested in some popular manuals. The operator's foot in the arm-pit and a strong grasp of the injured arm at the elbow, with traction firmly and continuously applied, will reduce the dislocation in a very short time, unless the head of the bone or the socket of the shoulder-blade are broken. In such cases the attendance of the surgeon must be sought before the reduction will be effected; but this kind of fracture, though common to old people, is unusual to children. As soon as the reduction is effected, the arm should be put into a sling, which may consist of a silk handkerchief hung round the neck, only just supporting the fore-arm and wrist, and keeping the arm closely to the side. It is not necessary to place a pad in the arm-pit, and bandages are not required, provided the arm is not raised.

Dislocation of the Wrist and Fingers.—The wrist may be dislocated either forward or backward. It is seen at once by the position of the hand. Grasp the hand firmly, and let an assistant take the arm at the elbow and each pull gently but steadily in opposite directions. The limb resumes its natural shape. It should then be placed upon a pillow, the patient sitting at a table until a proper cradle is prepared for it. This may consist of an old book-cover, a piece of pasteboard, or bit of the leather of an old saddle (pig's skin), or a piece of gutta-percha. It should be put in hot water so as to completely soften it, then cover it with cotton wadding, and placing the injured limb upon it, mould it to the arm from the elbow to the knuckles, turning it round the outer side so as to form a kind of spout, in which it may rest when the limb is placed in a sling; bind it loosely on with a linen bandage, and allow it to dry without changing the position of the arm. It must not be put on too tightly, or it will have to be removed on account of the natural swelling which will take place. The same course should be taken with individual fingers; but in that case it is not necessary to do more than envelope the finger and its neighbour, leaving the wrist free. There may be much difficulty in reducing dislocation of the thumb, unless it is done immediately. A surgeon will have to be summoned and chloroform probably administered before a satisfactory reduction can be effected. Dislocation of the ankle is somewhat similar to that of the wrist, but it is usually something more. There are three bones contained in its formation. It is a common thing for the bones at the wrist to be broken in old people and to simulate dislocation; the rule will generally be fracture at the wrist in the aged, but dislocation in children from a similar accident; but dislocation at the ankle always has more or less of fracture in it, and should be treated, if possible, by a surgeon from the first. There may be displacement in four directions, backwards, forwards, inward, or outward. The lateral dislocations will be self-evident, but the anterior or posterior are more difficult to distinguish, the heel being more prominent than usual, or less so, with great pain on the least movement being attempted. These symptoms will be sufficient to excite suspicion as to its nature, and should lead the principal to seek for surgical aid at once.

Dislocation of the Elbow.—Three bones enter into the formation of this joint, and like the ankle it may be dislocated in four directions, and will require skilled aid to effect its reduction, as it is often associated with fracture, and is a very serious injury.

Dislocation of the Collar Bone can scarcely be treated without skilled surgical assistance. There may be dislocation either at the shoulder or at the internal extremity of the bone where it rests upon the breast-bone. In either case it will be requisite to follow the directions of a skilful surgeon as to bandages and position, although if reduced by pulling the shoulder outwards immediately, it may slip into its place and remain there, provided the arm and shoulder are fixed in that position and are not moved again for some time, a pad being placed in the armpit, and the arm bandaged to the sides.

Dislocation of the Hip is a very serious injury, but if recognised quickly it may be reduced by a non-surgical hand, and the patient saved much suffering. A trifling injury sometimes seems to produce the deformity which results from it. The limb is shortened, the knee stands forward, and the toes rest upon the instep of the other foot. It is manifest when the patient stands erect. A jack-towel or some similar article should be passed between the thighs, and fastened securely above the head to something which will give fair purchase; another towel is passed round the thigh above the knee, and secured with clove hitch or sailor's knot, and the other end of the second towel being placed round the shoulders of the surgeon, he places his heel in the groin, and grasping the limb, guides it as he makes extension until it goes into its socket with an audible snap. Every minute which elapses after the injury before reduction is effected adds materially to the pain to the patient and trouble in effecting reduction.

Dislocation of the Knee.—This accident takes place in different directions, and considerable force is required to overcome it, which must be directed by a skilled hand. It is not a very common occurrence, but dislocation of the knee-cap is not uncommon. The little bone which lies in front of the knee-joint may be dislocated to the right or left, and when recognised immediately may be easily reduced by pressing suddenly upon the edge of the bone to the outer side of the joint, so as to press down the outer side, and at the same time tilt up the inner edge, and when the muscles attached to its upper border will bring it into position. If this does not effect the purpose aimed at, the leg of the patient, who is to lie on his back, must be bent as far as possible towards the face, when the leg should be suddenly bent back upon the thigh till the heel comes near to the hip. The operator presses the rim of the bone as he quickly straightens the leg again.

All dislocations require rest; warm applications to soothen the joint; no tight bandages should ever be used, but only those appliances which give gentle support.

Dislocation of the Jaw is very alarming, but soon remedied if it is recognised at once. The victim finds himself in a moment after gaping, or a blow, with the mouth wide open and incapable of speech. He can only indicate its nature by signs. The operator seats the patient in a low chair, and wrapping some leather or other tough material around his thumbs, stands before the patient, and placing the thumbs as far back as possible on the back of the lower jaw, he depresses the jaw by pressing upon the back teeth; at the same time presses the jaw forward with the fingers under the chin. If the thumbs are not fully protected they will be severely bitten as the jaw closes, but the deformity is at once remedied. It is very likely to recur in those who have been once subject to it. The use of chloroform enables a skilled hand to reduce some kinds of dislocations much more satisfactorily than used to be the case; but its use for such a purpose can only be made by a surgeon.

Fractures, or Broken Bones.—There are some general directions regarding fractions which should be known to all persons having the care of children.

It would be a great advantage if ambulance classes were made a part of the work of school life, so that children might be taught some of those common-sense rules which, if always carried out, would diminish the incidence of misfortune by reducing it to its first consequences. It is very usual if a person steps off a curb, or falls downstairs, or from a tree, for the bystanders to endeavour to put him on his legs again. They take hold of him anywhere, perhaps by the arm, which may be broken; or lift him up by the shoulders, when, if his thigh be damaged, they complete the fracture, which may have been only partial; or they try to make him stand, and a splinter from a broken bone in the leg at once pierces through the skin, and makes a simple fracture into a compound one. By this means a comparatively trivial accident becomes a very dangerous one, and limb or life may be lost by the injudicious action of ignorant friends in thus trying to help an injured person to stand up. The first thing to be done when an accident happens is to keep the patient in the recumbent position until the nature of his injury is manifest; advise him to be still, and to indicate the part which is damaged. Limbs may be straightened by extending them, but in no case should any course be taken which may lead to shortening, and care should always be taken to prevent the completion of a fracture. A so-called green-wood fracture is easily kept in position. It is like a piece of green wood, it is still in apposition in some of its parts, and can only require lateral support to keep it in proper position, and will not shorten. When it is the leg or the thigh which is damaged, this rule is especially necessary to be observed: do as is generally done with horses when they fall upon a city pavement; keep the head down, until arrangements have been made for his safe transport by stretcher to his home. He must be raised very carefully to get the stretcher underneath him. First roll him on one side, and place one edge of the stretcher beneath him, and then roll him back very gently; or, if it be the thigh which is broken, lift him by the shoulders and the knees, keeping the latter close together, the legs bent upon the thighs, and with a roll of clothes beneath them, so that legs hook over the roll, and prevent shortening as much as possible. If it be the leg which is broken the limb should be placed upon a pillow or some other soft material, raised a few inches by it, and the foot secured so as not to allow it to roll to the right or to the left. A soft pillow is the best adjunct; when it cannot be obtained, some hay or green grass arranged as a bed will effect the object aimed at.

Fractures are—1. Simple; 2. Compound; 3. Comminuted. They are simple when there is no outward damage to skin; compound when the bone pierces through the outer skin; and comminuted when the bone is broken into several pieces. It is very important to keep the malpositions which attend a fracture within the smallest possible compass, to prevent shortening, and on no account put on any kind of bandages too tightly. A bone is generally known to be broken by the grating feeling which arises from the broken ends rubbing together, and which are quite different to any other feeling which can be conveyed to the hand of the operator. This sound is called a *crepitus*, and is quite distinctive. A broken bone should be straightened by extending the lower end until the original shape of the limb is restored. It should be secured upon or within a pillow in the case of the leg, or with soft pads in the case of the arm, until a surgeon can take charge of it. In compound fracture it is best to cover up the wound as quickly as possible with carbolised oil, so as to keep it from contact with the external air; to wrap it up in its own blood; and prevent, as far as possible, the movement of the limb until it has been properly secured.

In *Fracture of the Ribs* the treatment consists in passing a flannel bandage round the chest, so as to limit the movement of the ribs, and compel the diaphragm (that is, the muscle between the chest and the abdomen) to do most of the work of respiration. The accident is recognised by the sharp pain on inspiration, giving rise to difficulty of breathing immediately after a fall or blow.

In *Fracture of the Thigh*—a misfortune which may happen to children with brittle bones—the patient should be kept on his back, with a bolster or some similar firm support under both knees, which should be secured together until the surgeon has arranged a proper bed. Compound comminuted fractures must be treated by the surgeon as soon as possible.

In closing the second series of instructions to teachers on medical subjects, it will be manifest that it is necessarily superficial in many parts, it being only possible to indicate the nature of an injury, without further instructions. Some of the deficiencies on strictly medical points will be remedied in the subsequent numbers of the PRACTICAL TEACHER, under the head of 'The Teacher's Health.'

Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.
AND THEODORE WOOD,
Joint Author of 'The Field Naturalist's Handbook.'

No. XXIV.—THE MARSUPIALS.

PART III.

RESEMBLING the rodents in so wonderful a degree that the presence of the marsupial pouch alone prevents it from being ranked with those animals,

the Wombat, or Australian Badger (*Phascolomys ursinus*) deserves more than a mere passing mention.

There are few creatures which appear more out of place in the situation assigned to them in the order of nature than this curious quadruped, which approaches so closely to the beaver in its structural characteristics that only a very careful examination could relegate it to its true position in the animal world. Not the slightest resemblance in outward form can we trace between the wombat and the animals which precede and follow it in the natural order, while the difference in habits is perhaps even more strongly marked. There can scarcely be a greater contrast than between the swift and agile movements of the kangaroos and the bandicoots and the deliberate ungainly pace of the wombat, whose heavy body and short limbs allow it to travel only by means of a slow and awkward waddle. And yet the presence of the marsupium indicates with certainty the true position of the animal in the scale of creation, and we can only wonder at the strange and at present inexplicable transitions which are found between the members of this curious group.

At first sight it bears a curious resemblance to the capybara of tropical America, although the wombat is essentially an inhabitant of the land, and the capybara passes much of its time in the water. The webbed feet of the former would, of course, distinguish it at once to a practised eye, but, as we shall presently see, the marsupials have their aquatic type, and produce an animal which is almost as much at home in the water as is the beaver itself.

According to the natives, the wombat, although no swimmer and never voluntarily seeking the water, does not fear it.

Not being a very intellectual animal, it can only accommodate one idea at a time in its brain. So, if it intends to make a journey, and should happen to come upon a river, it is not in the least disconcerted. Instead of being baffled by the river it goes straight into it, walks along the bed of the stream, and emerges on the other side.

If this be the case—and, as a rule, the natives are always right in their statements about wild animals—the wombat must possess, like the hippopotamus, the elephant, the whale, and the seal, the power of contracting its body so as to render itself heavier than water.

The wombat is spread over the greater portion of Australia, and is in some request for the sake of its flesh, which, although flavoured by a slight taint of musk, is yet considered to be tolerably good. It is not a large animal, the total length being about three feet, of which the head occupies some seven inches. The tail is scarcely visible, never exceeding half-an-inch in length. The fur, which is of a very hard and coarse quality, is grey, mottled with black and white, and changing to white upon the lower parts of the body.

The internal structure is very remarkable, no less than fifteen, and in some exceptional cases sixteen, pairs of ribs being found, only six of which reach the breast-bone.

As is the case with many of the smaller marsupials, the wombat possesses a remarkably mild and placid disposition, and will even allow itself to be captured without displaying any signs of anger. It is easily tamed, and seems at once to become reconciled to its new existence, seldom making any attempt at escape.

Gentle as it is at ordinary times, however, the wombat is yet subject to occasional gusts of rage, during the continuance of which it becomes a somewhat dangerous antagonist, capable of inflicting rather severe wounds with its sharp claws and teeth. These outbursts of anger, however, are generally of very rare occurrence, the wombat appearing as a rule to be one of the most apathetic animals upon the face of the earth.

In spite of its numbers, the wombat is not very often seen, except by those who go out in search of it, as it is strictly nocturnal in its habits, and seldom or never makes its appearance until darkness has fairly set in. During the daytime it conceals itself in long and deep burrows, which it excavates for itself by means of the sharp and powerful claws with which the fore-feet are provided. To such a depth are these tunnels sunk that even the natives themselves will seldom attempt to dislodge a wombat from his residence.

It is probable that the extreme length of these burrows is owing to the sensitive nature of the animal where heat and cold are concerned, the latter appearing to affect it to a wonderful degree.

This instinctive habit of burrowing renders it unsuitable for domestication. If it be placed in a yard paved so firmly that the creature cannot make a burrow, its natural conditions of life are altered, and, though it may live, it cannot be happy. It wants to burrow just as the skylark wants to soar and the swallow wants to emigrate, and neither of these creatures can be happy if their mode of life be forcibly altered.

In more than one instance, a tamed wombat has contrived to elude the vigilance of its keepers and to make a burrow. Following its instinct, it makes the burrow of very great length and depth, and when it passes underneath houses, as it has repeatedly done, the stability of these premises is seriously endangered.

The reader will remember that the natives rather shrink from the task of unearthing a wombat. To those who are acquainted with the habits of the aborigines, this statement means much.

There is no such accomplished digger in the world as your Australian 'black-fellow.'

Given a hole to be dug—dimensions and depth of no consequence—armed simply with a stick pointed and charred in the fire, the 'black fellow' will utterly vanquish the finest English 'navvy,' armed with pick-axe and shovel of the best make. The civilized man, plus his civilized implements, has to yield before a naked black savage and a stick. If the task were reversed, and an embankment had to be thrown up on level ground, the savage would be nowhere in comparison with the navvy.

But the very fact that the aborigines, who can burrow almost as fast as if they were moles, hesitate about attacking the stronghold of the wombat, speaks volumes for the tremendous burrowing powers possessed by the latter.

In spite of the difficulty of keeping the animal above ground, some twenty examples have been maintained in the Zoological Gardens, being representatives of at least three distinct species.

The food of the wombat appears to be entirely of a vegetable nature, the animal thriving in captivity upon lettuce-leaves, cabbage-stalks, and similar articles of diet. For milk it always evinces a great partiality, and has even been known to push the covers off the vessels containing the coveted beverage, and to bathe in the milk as well as drink it.

Geological researches in New Holland have resulted in the discovery of the fossil remains of an animal closely allied to the wombat, but which, when living, must have almost equalled the hippopotamus in dimensions. It is therefore, to say the least, probable that further investigations would result in the discovery of the remains of many species now extinct which would tend to throw some light upon this remarkable group of animals.

THE curious little Bandicoots (*Perameles*), easily recognizable by their rat-like aspect, are next upon our list.

The mode of progress adopted by these little creatures is very strange, consisting of a curious mixture of running and leaping, caused by the peculiar structure of the legs and feet. Notwithstanding this apparently awkward gait, however, the bandicoots can attain a tolerably high rate of speed, the more remarkable when the small size of the animals is taken into account.

The most interesting of these animals is the long-nosed bandicoot (*Perameles nasuta*), so called from the peculiar formation of the snout, which strongly reminds one of the shrew-mice of our own country, being prolonged in a precisely similar manner. The feet are armed with long and powerful claws, by the aid of which the animal is enabled to dig for the roots, etc., upon which it feeds. The fur is of a pale brown hue, pencilled with black upon the upper portions of the body, and merging into white upon the lower surface. The total length of the animal is about twenty-one inches, five of which are occupied by the tail.

The diet of the long-nosed bandicoot is stated to be entirely of a vegetable character, and to consist chiefly of the roots which it extracts from the ground by means of its long and powerful claws. That these roots form the major portion of its food we can hardly doubt, but it seems more than probable that this vegetable diet is largely qualified by the worms, grubs, etc., turned up by the animal while digging, a conjecture borne out by the shrew-like appearance of the head.

One curious species is appropriately called the Rabbit-eared Bandicoot (*Perameles lagotis*).

Several examples of this animal have been kept in the Zoological Gardens, and never failed to attract attention. Their long, semi-transparent ears, and their peculiar tripping gait, which really looked like affectation personified, distinguished the little creatures from their surroundings.

THE pretty little Chæropus (*Chæropus castanotis*) is evidently closely allied to the bandicoots, from which it differs chiefly in the formation of the fore-paws, which bear a curiously close resemblance to those of the swine. These feet are formed with two toes only, each of which is armed with a hoof-like claw, the result being a wonderfully exact likeness in miniature to the foot of the pig.

The chæropus is a native of New South Wales, inhabiting the thick and tangled vegetation popularly known as 'scrub.' It is a rather curious animal in appearance, possessing, although in a less striking degree, the elongated snout of the long-nosed bandicoot, while the ears are of enormous dimensions in comparison with the size of the body. The fur, which is of a remarkably woolly texture, is of a pale brown hue, fading almost to white upon the lower parts of the body. It is but a small animal, being about equal size to the ordinary English rabbit.

By way of a habitation, the chæropus constructs a rather elaborate nest of grass and leaves, generally selecting the base of some bush as the situation for its domicile. The little animal appears to take the greatest pains to conceal its abode from all excepting itself, and generally succeeds so well in its endeavour that none but a practised eye can detect the hidden nest.

SEEMING to be the principal marsupial representative of the carnivora, the Tasmanian Wolf (*Paracyon cynocephalus*) next claims our notice.

This animal really presents a wonderfully wolf-like appearance, and well deserves its popular title.

Even the feet are formed in precisely the same manner as are those of the animals of the dog family, being furnished with short and blunt claws only, and therefore not suited for climbing trees, as are those of most of the previously described marsupials. Indeed, but for the tail, which is long and tapering, the Tasmanian wolf might really be imagined to belong to the group of animals from which it derives its title.

The nature of the food of this animal is at once evident from the structure of the teeth, which are sharp and pointed just as are those of the carnivora themselves. Yet the animal is by no means as predaceous as might be expected, seeking its prey chiefly among the smaller animals, molluscs, and even insects. The sea-shore appears to furnish it with a large proportion of its food, the mussels, crabs, and other small creatures so plentiful upon the coast seeming to form a very favourite article of diet.

Few things in the way of food, however, seem to come amiss to the Tasmanian wolf, which has even been known to swallow the echidna itself, in spite of the sharply-pointed spines which radiate upon all sides of the body. The duckbill, too, often falls a victim to its attacks, notwithstanding its powers of swimming, and the long and tortuous burrow in which it makes its habitation.

Nor does the Tasmanian wolf despise larger game, contriving to capture the bush kangaroo in spite of its superior speed and activity. The flocks, too, of the settlers frequently suffer very severely from its attacks, so much so that many of the earlier colonists found it an utter impossibility to preserve their herds until the Tasmanian wolves had been driven from the neighbourhood. And this proved by no means an easy task, for, even when the greater number of the destructive animals had been killed, the remainder used to prowl round the settlements, in order to pick up any straggling animal that might fall in their way.

At the present time, owing to the constant persecution to which it has naturally been subjected, the Tasmanian wolf is a comparatively scarce animal, and is seldom seen except in those retired districts in which it has taken refuge. It seems principally to abound upon the summits of the western mountains, at an elevation of three or four thousand feet above the level of the sea, and appears to thrive in its lofty haunts, notwithstanding the inclemency of the climate during the greater part of the year.

Like most of the marsupials, the Tasmanian wolf is a nocturnal animal, concealing itself during the daytime in some deep crevice in the rocks to which the detested light cannot penetrate. In this gloomy

retreat are produced the young, usually three or four in number, which are there secure from the attacks of almost any enemy until they are sufficiently strong to care for themselves.

In point of size, the Tasmanian wolf is about equal to an ordinary jackal, attaining to an average length of about four feet, fifteen or sixteen inches of which are occupied by the tail. It is said, however, that some specimens are of far larger dimensions, six feet being mentioned by some writers as a not unusual length. The marking of the fur is rather striking, the ground-colour being a greyish-brown, while a series of black stripes cross the back from the shoulders to the root of the tail. These stripes, which are small and narrow at first, gradually increase in length until they reach the haunches, diminishing again as they approach the tail. On account of these stripes, the animal is often known by the title of Zebra Wolf.

The marsupial bones are not developed in this animal, their position being only indicated by cartilage.

FEROCIOUS alike in aspect and in disposition, few animals better deserve their popular title than the Tasmanian Devil (*Diabolus* [or *Dasyurus*] *ursinus*). Utterly unamenable to kindness, the animal seems to be one of the very few which are hopelessly untameable, flying even at the very hand which supplies it with food. Nor does its appearance belie its character, for it is as savage-looking a creature as can well be imagined.

Jet black in general hue, the body is marked here and there with spots and dashes of white, which afford a very striking contrast to the sombre ground-colour of the rest of the fur. Across the breast runs a white mark, varying considerably in size and shape in different individuals, while a second similar, although smaller, patch is generally to be found near the base of the tail. Behind the eyes is placed a tuft of very long hairs, while a second is found immediately above them.

The animal is of a rather clumsy build, and, except when under the influence of its easily-aroused passions, is generally very sluggish in its movements. It is not a very large animal, being very short-legged, and averaging about twenty-eight inches in total length, of which the tail occupies one-fourth.

Notwithstanding its small size, however, the Tasmanian devil is almost as destructive as the last-named animal, its extreme ferocity appearing to compensate for its inferiority in size and strength. Farmyards suffer greatly from its depredations, which are of almost nightly occurrence until it is driven from the neighbourhood. Indeed, the animal appears to possess one good quality, namely, that its flesh is sufficiently tender and well-flavoured to be in some request, and is by some even considered as a dainty.

In captivity it is a treacherous sort of creature. Nowhere are animals treated more lovingly than in the Zoological Gardens, or their instincts more carefully studied, and consequently there are but few animals which are not brought to acknowledge the kindly influence of man. The Tasmanian devil is one of these beings, a fact of which I have had practical experience. Some years ago, being engaged in a series of magazine articles upon the Zoological Gardens, I was permitted to enter many of the enclosures. On one occasion I fortunately happened to look round rather sharply, and was just in time to avoid a severe injury. A Tasmanian devil had stolen silently behind me, and had just got one of my ankles into its jaws. With the side of the other foot I caught it in the ribs and sent it rolling and over in a paroxysm of fury, and before it had recovered its feet I slipped out of the enclosure.

The jaws of this animal, which open very far back, and are armed with sharp and powerful teeth, are quite as formidable as those of the badger, and, if possible, it fights even more fiercely, the passion of rage seeming to be predominant in its nature, and that of fear to be wholly wanting.

The Tasmanian devil usually makes its retreats in the thickest recesses of the forests, generally digging for itself a deep burrow in which it may avoid the unwelcome light of day. The fore-feet are admirably suited for these fossorial operations, as they are furnished with sharp and powerful claws, which tear up the earth in a wonderfully short space of time.

The hinder-feet are formed very much like those of the bear, this structure giving rise to the specific title of *ursinus*. Like those animals, the Tasmanian devil can sit upon its hinder feet, and manipulate food, etc., with the fore-paws, which it uses with remarkable dexterity.

THERE are many other Dasyures, of which the Common Dasyure (*Dasyurus viverrinus*) will serve as a type. This animal, although by no means of large dimensions, is yet of very striking appearance, the dark blackish-brown fur being diversified with large white spots, varying in size and position in almost every individual. The tail, which is not prehensile, is moderately long, and is thickly covered with hair; hence the title of *Dasyurus*, or 'hairy-tailed,' which has been applied to these animals.

The dasyures are nocturnal animals, and generally pass the hours of daylight hidden away in the hollows of some decaying trees, whence they issue after nightfall in search of prey. This consists chiefly of the smaller quadrupeds, birds, insects, etc., as well as of the various molluscs and crustacea to be found upon the sea-coast, which appears to be a favourite haunt of these animals.

The feet of the dasyures are furnished with strong curved claws, which enable them to run with wonderful ease amongst the branches of trees. Upon the hinder paws the thumb is entirely wanting.

In spite of its small dimensions and harmless appearance, the little Phascogale (*Phascogale penicillata*) is one of the most destructive of all the marsupials. No house or farmyard is safe from its attacks, if the smallest aperture be left for its admission, for it contrives to insinuate its body in some wonderful manner through an opening scarcely large enough, apparently, to allow even the head to pass. And, moreover, its scandent powers are so great that it can ascend a perpendicular wall, provided only that there be the smallest inequality into which the claws can be thrust.

Once having obtained admission to a house or farmyard, the mischief worked by the little animal is almost incredible. Poultry, in particular, appear to suffer very greatly from its ravages, the fierce little creature seeming to find pleasure merely in the act of killing, and generally slaying far more birds than it can possibly devour.

Even by man himself the phascogale is not easily overcome, its sharp claws being capable of inflicting

wounds of a severity quite disproportioned to the size of their owner. An unarmed man, indeed, although he would probably eventually prove the victor, would certainly suffer very severely if he were imprudent enough to attack one of these animals.

The phascogale usually selects for its habitation the hollow trunk of some tree, in which the young are brought forth and nurtured. It is not so strictly nocturnal in its habits as are most of the marsupials, and, although generally preferring to seek its food after night has set in, is yet frequently to be noticed at large during the hours of daylight.

This little animal is only seventeen inches in total length, of which at least half is occupied by the tail, so that in actual bulk it is scarcely larger than an ordinary British rat. The colour of the fur is a light grey, the tail, however, which is adorned for the greater part of its length by a fringe of long hairs, being of a jetty-black. Owing to the tufted tail, the animal is often known as the Brush-tailed Phascogale.

Science Notes.

M. PASTEUR'S INVESTIGATIONS.—At the last meeting of the Academie des Sciences, in Paris, a paper was read by M. Pasteur, in which he gave an account of a remarkable series of experiments on a large scale, which completely establish his views as to the efficacy of vaccination or inoculation as a preventive against splenetic fever among the lower animals. Work on this subject, it is well known, has occupied M. Pasteur for many years, and his investigations have pointed clearly to the prevention of many diseases by similar means to those adopted at present only against smallpox. It appears from his paper that the farmers in the Department of the Eure-et-Loire were so struck with the conclusive results of the experiments made in 1880-81 on animals with regard to splenetic fever that they determined to try the suggested remedy. In the course of the past year nearly 80,000 sheep, between 4,000 and 5,000 head of cattle and 500 horses have been vaccinated, with the following results:—The number of sheep vaccinated within the year was 79,392. For the last ten years the average annual loss from liver rot has been 7,327, or 9 per cent. Since the introduction of vaccination this loss has been reduced to 518, or ·65 per cent. Among the flocks which were only partially vaccinated, there were 2,308 sheep vaccinated and 1,659 not, and the loss among these was only eight among the vaccinated, while it was sixty among the unvaccinated sheep, making the percentages respectively ·35 and 3·7, or rather more than ten times as great in the latter case. These sheep were brought from different parts of the department, and those vaccinated were fed and treated exactly in the same way as those not vaccinated, so that local causes can have played no part in bringing about the results. Coincidently with these experiments on the sheep, 4,562 head of cattle were vaccinated; only eleven of these died from fever, so that the rate of mortality among them from this cause, which was 7 per cent. a year ago, has been brought down to ·24 per cent. With regard to horses, the experiments were not on so large a scale, but 524 were treated, of which number only three died. These experiments clearly establish the value of M. Pasteur's work, and raise it from a position of scientific interest to one of great practical importance in these days of agricultural depression. M. Pasteur is at present engaged in working out the nature of hydrophobia, with a view to ascertaining whether anything can be done to render this scourge less deadly. His experiments lead him to believe that one, at least, of the forms of rabies can be much mitigated in severity by a similar process of inoculation.

* * * * *

A UNIFORM INTERNATIONAL MERIDIAN.—It is announced from the United States that the Government have decided to take the initiative in promoting measures for adopting a uniform international meridian. The inconvenience of the present system has long been felt. The English meridian is taken as that of Greenwich, the French one as that of Paris, and so on; and now that railways and steam navigation have so enormously developed, this confusion of longitude according to nationality is of the greatest inconvenience to commerce. There has been considerable stir in America upon the point both in commercial circles and among the learned societies. It is, in fact, to the latter that the credit is due of having brought the Government to the point of taking the matter up.

* * * * *

KELWAY'S ELECTRIC LOG.—During some recent trials of Kelway's electric log on board of the steam-tug *Pixie*, a number of runs gave a mean of 7·2724 knots passed over by the vessel. Actual measurement of the distance showed it to be 7·2768 knots. The electric log, therefore, gives an error of only ·06 per cent., or about a yard in a mile, which is probably the nearest approach to accuracy that has ever been obtained by any log yet tried.

* * * * *

THE RENOVATION OF OLD POSTAGE STAMPS.—Mons. Naquet, the well-known French professor of chemistry, has been making experiments on the possibility of removing the defacing marks put upon stamps by the Post Office. The French Minister of Posts and Telegraphy has brought the loss to the revenue occasioned by such renovation before the Chamber, which has appointed a commission to investigate the matter, and M. Naquet is a member of this commission. His own experiments are interesting. He found that neither solution of ether, carbonic disulphide, boiling oil, gum, nor collodion produced any

effect upon the material used to deface the stamps. The alkalies, however, produced a different result. Concentrated solution of potassium, into which he dipped the stamps, made them almost perfectly white, but still the obliterating marks were visible. A much weaker solution of the same metal, however, acted on the defacement, and left the colour of the stamp almost unaltered. M. Naquet rubbed the surface of the stamps with his finger moistened with the alkaline liquid, and then washed them thoroughly in fresh water. By this means they were made to appear new; in fact, so closely did they resemble unused ones that some which he used afterwards, to see if they would attract attention at the Post Office, escaped notice altogether.

* * * * *

EXPLORATIONS IN ALASKA.—The *Vossische Zeitung* reports the return of a German traveller, Dr. Krause, from a journey in the Tschuktsh Peninsula and Alaska, undertaken at the instance of the Bremen Geographical Society. Dr. Krause crossed the Pacific with his brother from San Francisco in a small schooner, and landed in Lawrence Bay in 1881. They continued their explorations partly by land and partly by water in a whale boat, taken for the purpose, for eight weeks. In the winter of the same year they spent some time at Chilkoot, a trading port of the North-west Trading Company, under about the 59th degree of north latitude, and 135th degree west longitude, and during their stay a series of natural history and ethnographic observations were made during excursions undertaken at various periods among the Thlingit Indians. Dr. Krause remained in Alaska till last autumn, returning to New York on his way back to Germany. He will shortly deliver lectures in Bremen on his travels, and will exhibit the very fine collection of natural history specimens and other interesting objects which he has brought home with him from Alaska.

* * * * *

CHEESE PREPARED FROM BEANS.—It has long been known that very curious, and to European ideas very unattractive, viands find prominent places on the tables of the natives of China and Japan. The latest importation from these regions is one which may possibly commend itself more to our tastes than many of which we have had accounts. It is a kind of bean which, besides being cooked and eaten like other vegetables, is capable of being made into what is said to be very excellent cheese, possessing a very delicate flavour, which distinctly recalls that of Parmesan. In its composition it more closely resembles animal food than any other vegetable known to us, containing a considerable quantity of fatty matter, and much albumen. Besides being likely to form a part of our own food supply, it will afford fodder for horses and cows, which are said to be very fond of the husk. It requires for its cultivation a fairly high temperature and a tolerably constant climate, so that it is not likely to be cultivated in England, but the south of France seems to afford a suitable home for it.

* * * * *

VEGETABLE BUTTER.—Mr. N. Jepson, a prominent English vegetarian, has, in consequence of his unwillingness to use poor and adulterated animal fats for butter, sought a substance in the vegetable kingdom that may replace them. He says that he has found such a one in a composition made as follows:—Four ounces of finest Brazil nuts are pounded very fine, and, with an equal weight of pure olive oil, are rubbed into a smooth jelly. To this, eight ounces of finest wheat flour and a quarter of an ounce of salt are added, and the whole rubbed into a smooth paste, which can be used for butter.

* * * * *

THE FLATTERS' EXPEDITION.—The sad fate of Colonel Flatters and his associates, who were engaged in the important work of surveying the proposed route of the trans-Saharian Railway, has been commemorated by the Paris municipal authorities, by the erection of a handsome monument in the park of Montsouris. It will be remembered, that while they were engaged in the objects of the survey, they were murdered at Brama with all their escort, by Tonaregs, on the 16th of February, 1881. The monument, in addition to the names of the members of the ill-fated expedition, contains the legend: 'For France they braved perils and death;' and on its sides are inscribed, 'Honour and Country,' and 'Science—Civilisation.'

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

37	778
906	82
8	696 Ans.
577	
56	103
1584 Ans.	36
	67 Ans.

STANDARD II.

A.	B
3659 84 307356 Ans.	17138 8950 8188 Ans.
15012 7961 7051 Ans.	8)36872 4609 Ans.
7)25956 3708 Ans.	3659 48 175632 Ans.

STANDARD III.

(1) Add up £84 19s. 10¾d.; £6 17s. 8½d.; 9s. 5¾d.; £8 17s. 6¾d.; £905 14s. 11½d.
Ans. £1006 19s. 7¼d.

(2) From £5014 17s. 0¼d. take £892 18s. 10½d.
Ans. £4121 18s. 1¾d.

(3) In a battle where 50,500 soldiers were engaged, 2927 were killed. How many survived?
Ans. 47,573.

(4) Divide 793,506 by 98. Ans. 8097.

(5) Multiply the number of days in September, October, and November by 106. Ans. 9646.

STANDARD IV.

(1) Divide fifty-eight pounds two shillings and sevenpence halfpenny by fifty-nine.
Ans. 19s. 8¼d.—51.

(2) How many boxes of sardines will it take to weigh 100,000 cwt., if each box contains 6 ozs.?
Ans. 29,866,666 + 4 ozs. left.

(3) Multiply fifty-nine pounds fifteen shillings and ninepence by fifty-nine. Ans. £3527 9s. 3d.

(4) There are 59 boys in a school. How much will it take to provide them with reading-books at 10d., atlases at 2s., histories at 9d., and copy-books at 2½d. each? Ans. £11 3s. 8½d.

(5) How many miles are there in 60,720 feet?
Ans. 11½ miles.

STANDARD V.

(1) A bill:—

	£	s.	d.
½ bushel of apples at 8½d. per gallon	= 0	2	10
15 dozen pears at 1½d. each	= 1	2	6
½ cwt. of grapes at 6d. per lb.	= 1	8	0
Ans.	£2	13	4

(2) 78 hhd. 15 gal. 3 qt. 1 pt. at £4 10s. per hhd. (beer measure). Ans. £352 6s. 5½d.

[N.B.—Hogshead, being an obsolete measure, ought not to have been given, unless its equivalent in gallons (54) were also given.]

(3) If 356 articles cost £109 9s. 3d., how much must I give for 2848? Ans. £875 14s.

(4) 56 yds. 2 ft. 11 in. at 2s. 3d. per yd.
Ans. £6 8s. 2¼d.

(5) A bill:—

	£	s.	d.
57 pairs of boots at 15s. 10½d. per pair	= 45	4	10½
57 „ „ 9s. 11d. „	= 28	5	3
500 laces at 1½d. each	= 3	2	6
Ans.	£76	12	7½

(6) 47 articles at £79 15s. 10¾d. each.
Ans. £3750 7s. 1¼d.

STANDARD VI.

(1) A road 5 miles long required water-pipes laying. If each pipe is 6 ft. 6 in. long, and 100 pipes are laid, what fraction of the road is left without pipes? Reduce the fraction to its lowest terms. Ans. $\frac{61}{528}$.

(2) Multiply ·003 by ·039, and divide the product by 130. Ans. ·0000009.

(3) If a man bought 2250 oranges at 15 pence per score, and sold half of them at 3 for 2½d., and the remainder at 9d. per doz., what did he gain?
Ans. 7s. 9¾d.

(4) If a train travelled 34 miles 5 fur. in 5 hrs. 20 min., how many miles would it travel in the return journey in 4 hrs. 10 min.? Ans. $27\frac{13}{256}$ miles.

Mathematics.

STAGE I.

EUCLID I. 11 AND 13.

(1) Add $8a^2 - 9x^2 + 5 + 7a^2 + 4x^2 - 3 - 11a^2$.
Ans. $4a^2 - 5x^2 + 2$.

(2) From $a^3 + 3a^2b + 3ab^2 + b^3$ take $a^3 - 3a^2b + 3ab^2 + b^3$.
Ans. $6a^2b$.

(3) $\div a^4 - 81b^4$ by $a - 3b$.
Ans. $a^3 + 3a^2b + 9ab^2 + 27b^3$.

STAGE III.

EUCLID I. 37, AND II. 3 AND 6.

(1)
$$\left.\begin{aligned} \frac{5x}{9} + \frac{9}{y} &= 11 \\ \frac{5y}{9} + 9x &= 167 \end{aligned}\right\}$$
Ans. $x = 18, y = 9$.

(2) $\sqrt{a^2 + b^2 + c^2 + 2ab + 2ac + 2bc}$.
Ans. $\sqrt{(a+b+c)^2} = a + b + c$.

(3) Find G.C.M. of $x^4 - a^4$ and $x^3 + bx^2 - a^2x - a^2b$.
Ans. $x^2 - a^2$.

(4) Reduce to its simplest form $\frac{x^2 - 9x + 20}{x^2 + 6x - 55}$.
Ans. $\frac{x-4}{x+11}$.

Grammar.

STANDARD II.

Point out the nouns in the following: 'James ran into the garden and plucked a flower for his sister Mary.'

STANDARD III.

Nouns, verbs, and adjectives in the following: 'America is only slowly recovering from the effects of the Civil War into which it was plunged by the force of patriotic impulses.'

STANDARD IV.

Parts of speech in the following sentence: 'It is a familiar fact that Belgium is more densely populated than any other European country, and if it is a source of happiness that a dense population should be largely composed of landowners, Belgium possesses this advantage in a most remarkable degree.'

STANDARDS V. AND VI.

To analyse sentences, of which the following was the first given: 'David Livingstone, the African missionary, was born at Blantyre, near Glasgow.'

Dictation.

STANDARD I.

Busy, straw, chicken, shell, kneel, useful, cloth, fresh.

STANDARD II.

As you may suppose, the miner's life is not a pleasant one, neither is it free from danger. Sometimes they are stifled by foul air or drowned by a sudden rush of water.

STANDARD III.

There are few vegetables that do not contain sugar at some time or other of their lives. Carrots, turnips, and parsnips contain sugar; and from all these wine can be made. Starch, you know, can be changed into sugar, and so can linen rags.

STANDARD IV.

'Mercury is the heaviest of fluids, and it never freezes except under the extreme cold of the Polar regions. These properties have led to its use in barometers, as a measure of the weight of the atmosphere. At the same time, the readiness with which it expands with heat and contracts with cold adapts it well for being used in thermometers. Other uses of mercury are in gilding and silvering copper, and in plating glass for mirrors.'

Pupil Teachers' Literature.

BY AN INSPECTOR.

For Pupil Teachers at end of First Year. 66 *lines.*

[N.B.—Where the lines of Poetry are as short as this, it is usual for Inspectors to require more than the bare amount fixed by the Code.]

LUCY GRAY; OR, SOLITUDE.

OFT I had heard of Lucy Gray:
And, when I crossed the wild,[1]
I chanced to see at break of day
The solitary[2] child.

No mate,[3] no comrade, Lucy knew;
She dwelt on a wide moor,
The sweetest thing that ever grew
Beside a human door.[4]

You yet may spy[5] the fawn[6] at play,
The hare upon the green;
But the sweet face of Lucy Gray
Will never more be seen.

'To-night will be[7] a stormy night—
You to the town must go,
And take a lantern, child, to light
Your mother through the snow.'

'That, father, will I gladly do;
'Tis scarcely afternoon—
The minster clock[8] has just struck two,
And yonder is the moon!'

At this the father raised his hook,[9]
And snapped the fagot-band;[10]
He plied his work:[11]—and Lucy took
The lantern in her hand.

Not blither[12] is the mountain roe:[13]
With many a wanton[14] stroke
Her feet disperse[15] the powdery snow
That rises up like smoke.

The snow came on before its time:[16]
She wandered up and down;
And many a hill did Lucy climb,
But never reached the town.

The wretched parents[17] all that night
Went shouting far and wide;
But there was neither sound nor sight
To serve them for a guide.

At daybreak on a hill they stood
That overlooked the moor,
And there they saw the bridge of wood
A furlong from their door.

They wept, and turning homeward, cried,
'In heaven we all shall meet;'—
When in the snow, the mother spied[18]
The print of Lucy's feet.

[1] *The wild*, the moor.
[2] *Solitary*, lonely.
[3] *Mate*, companion.
[4] *Beside a human door.* The girl is said to have grown up 'beside' or outside the door of a human being's dwelling, as she spent so much of her time in the open air.
[5] *Spy*, peep at, watch from a hiding-place.
[6] *The fawn*, the young deer.
[7] *To-night will be*, etc. Lucy's mother had probably gone marketing to the town, and noticing that the night threatened, her father tells the girl to take a lantern to meet her and light her home.
[8] *The minster clock*, the clock of the min(i)stry (place of worship), church or cathedral. Thus York Cathedral is called York *Minster*, and the word also occurs in West*minster*. Notice how cheerfully the child obeys—nay, how eagerly she makes light of the duty by pointing out how early it is, and how the moon already promises a bright, if stormy night.
[9] *His hook*, his bill-hook, an instrument like a sickle for cutting brambles and so forth.
[10] *The fagot-band*, the coarse grass or reed that bound up his fagots.
[11] *Plied his work*, went on with his work.
[12] *Not blither*, not gayer, more sportive.
[13] *Roe*, deer.
[14] *Wanton*, frolicsome.
[15] *Disperse*, scatter.
[16] *Before its time, i.e.*, before it was expected.
[17] *The wretched parents.* We must suppose Lucy's mother to have found her way home, and then to have started with her husband in search of their child.
[18] *Spied*, caught sight of.

Half breathless[10] from the steep hill's edge
They tracked the footmarks small,
And through the broken hawthorn hedge,
And by the long stone wall;

And then an open field they crossed—
The marks were still the same;
They tracked them on, nor ever lost;[20]
And to the bridge they came.

They followed from the snowy bank
Those footmarks one by one,
Into the middle of the bank,
And further there were none!

Yet some maintain[21] that to this day
She is a living child,—
That you may see sweet Lucy Gray
Upon the lonesome wild.

O'er rough and smooth[22] she trips along
And never looks behind;
And sings a solitary song,
That whistles in the wind.

It is most pathetic to think that after all the poor child had very nearly found her way home again, had indeed half crossed the bridge a furlong from her door, after wandering across the wide moor as far as the steep hill down which she had passed in safety. We may imagine the feelings of the parents as they trace her footmarks along the edge of the precipice and through the snowdrifts, and believe them to have almost breathed again when they see her steps now tending so near home; indeed, we can suppose them almost trusting to find their darling safe in their cottage again.

But the bridge now confronts them, and their fears are redoubled, when they notice that Lucy's footmarks lead towards it. A few steps more and they stand upon the bridge looking down into the snow-swollen torrent that has swept their darling for ever from their sight.

NOTE AS TO THE RECITATION.

In recitation there should be a good pause after the first verse, as the poem then passes from a personal reminiscence to a narrative in which the speaker has taken no part. The 2nd and 3rd verses should be said with tenderness, which should pass into deep feeling with the 11th and 12th lines.

Verse 4 should be said slowly and kindly, verse 5 quickly and eagerly, verse 6 quietly, verse 7 brightly. A pause should follow this verse, and the rest of the poem should be recited in a manner expressive of the alternations between anxiety and despair, and then again between hope and fear. Verses 12 and 13 should be said very rapidly and almost breathlessly, and verse 14 should be repeated very sadly and slowly, and there should be a long pause before its last line.

[10] *Half-breathless*, losing their breath, through hurrying so fast.
[20] '*Nor ever lost*,' nor ever lost (them).
[21] *Maintain*, 'affirm,' 'state their belief.'
[22] *O'er rough and smooth*, over rough and smooth (places).

For Pupil Teachers at the end of the Second Year.
84 lines. (80 required.)

'A PERFECT WOMAN.'

BY WILLIAM WORDSWORTH.

SHE was a phantom[1] of delight
When first she gleamed upon my sight;

A lovely apparition, sent
To be a moment's ornament;[2]
Her eyes as stars of twilight fair;
Like twilight's, too, her dusky hair;
But all things else[3] about her drawn
From May-time and the cheerful dawn;
A dancing shape, an image gay,
To haunt, to startle, and way-lay.[4]

I saw her upon nearer view,
A spirit, yet a woman too!
Her household motions light and free,
And steps of virgin liberty;
A countenance in which did meet
Sweet records, promises as sweet;
A creature not too bright or good
For human nature's daily food;
For transient[5] sorrows, simple wiles,[6]
Praise, blame, love, kisses, tears, and smiles.

And now I see with eye serene
The very pulse of the machine,
A being breathing thoughtful breath,
A traveller between life and death;
The reason firm, the temperate will,
Endurance, foresight, strength, and skill;
A perfect woman,[7] nobly planned,
To warn, to comfort, and command;
And yet a spirit still, and bright
With something of angelic light.

How exquisitely the poet reverts to this spiritual aspect of his heroine, and how, as he parts from her, he illumines her image with the purest homage man could pay to woman.

NOTE AS TO THE RECITATION.

The general line of thought in the below notes indicates the expression to be given in the recitation of the poem. The first stanza should be given brightly and yet tenderly; the second with quiet enjoyment, touched with playfulness in the last four lines. The last stanza should be earnestly rendered as far as the seventh line, where the thought becomes more exalted and where admiration of expression should pass into a tone of gentle reverence.

[1] The words *phantom* and *apparition* here have the same meaning, *i.e.*, that of a beautiful appearance, so fair, as to seem supernatural.

[2] *A moment's ornament.* She was so little seen, that she is spoken of as merely giving brightness to a moment. Her eyes are compared to the soft stars of evening, not to the brilliant ones of night, her hair to the shadows of twilight. It would appear, therefore, that she was dark haired, and brown or violet eyed.

[3] *All things else;* her blush and smile and sunny nature partake of the bright beauty of daybreak and the month of May.

[4] *To way-lay*, here, to lie in wait for.
She has hitherto only been seen in moments of leisure and light-heartedness. But in her home-life she proves to be a true woman, as well as with somewhat angelic about her; cheerfully doing her duty, and her face expressive of habitual kindness; yet she is not so spiritualized as to be above being interested in every-day life, or superior to its errors and infirmities.

[5] *Transient*, passing.

[6] *Wiles*, endearments.

[7] Upon a still closer view, she appears more thoughtful, more conscious that this life is but a pilgrimage, reasonable, temperate, enduring, provident, capable, discreet, in fine '*a perfect woman*,' that is to say, with all the highest attributes of womanhood ripened to perfection, and *yet a spirit still.*

TO OCEAN.

BY LORD BYRON.

ROLL on, thou deep and dark blue ocean—roll!
Ten thousand fleets sweep over thee in vain;
Man marks the earth with ruin—his control
Stops with the shore; upon the watery plain
The wrecks are all thy deed, nor doth remain
A shadow of man's ravage, save his own,[1]
When, for a moment, like a drop of rain,
He sinks into thy depths with bubbling groan,
Without a grave, unknelled,[2] uncoffined, and unknown.

His steps are not upon thy paths,—thy fields
Are not a spoil for him,—thou dost arise
And shake him from thee; the vile strength he wields
For earth's destruction thou dost all despise,
Spurning him from thy bosom to the skies,
And send'st him, shivering in thy playful spray
And howling, to his gods,[3] where haply lies
His petty hope in some near port or bay,
And dashest him again to earth:—there let him lay.

The armaments which thunder-strike[4] the walls
Of rock-built cities, bidding nations quake,
And monarchs tremble in their capitals,—
The oak leviathans,[5] whose huge ribs make
Their clay creator[6] the vain title take
Of lord of thee,[7] and arbiter of war,[8]—
These are thy toys, and, as the snowy flake,
They melt into thy yeast of waves,[9] which mar
Alike the Armada's pride,[10] or spoils of Trafalgar.[11]

Thy shores are empires, changed in all save thee—
Assyria, Greece, Rome, Carthage,[12] what are they?
Thy waters wasted them, while they were free,
And many a tyrant since; their shores obey
The stranger, slave, or savage; their decay
Has dried up realms to deserts:—not so thou;—
Unchangeable save to thy wild waves' play,
Time writes no wrinkle on thine azure brow—
Such as creation's dawn beheld, thou rollest now.

Thou glorious mirror! where the Almighty's form
Glasses itself in tempests; in all times—
Calm or convulsed, in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Dark-heaving,—boundless, endless, and sublime,
The image of Eternity—the throne
Of the Invisible; even from out thy slime
The monsters of the deep are made; each zone
Obeys thee; thou goest forth, dread, fathomless, alone.

And I have loved thee, Ocean, and my joy
Of youthful sports was on thy breast to be
Borne, like thy bubbles onward: from a boy
I wantoned with thy breakers[13]—they to me
Were a delight; and if the freshening sea
Made them a terror—'twas a pleasing fear,
For I was as it were a child of thee,
And trusted to thy billows far and near,
And laid my hand upon thy mane, as I do here.

Note that every stanza in this fine passage is a separate sentence. Observe, too, the metre—eight-rhymed decasyllabics (ten-syllabled lines) followed by an Alexandrine or twelve-syllabled line—lines 1 and 3, 2, 4, 5, and 7, and 6, 8, and 9 rhyming with each other. This measure is best known as the Spenserian stanza, from the great and noble use made of it by the poet, Edmund Spenser.

FOR RECITATION.

The first stanza should be said deliberately, care being taken to mark the connection between its subsidiary clauses and sentences, without spoiling the continuous effect of its general structure. A disdainful tone should be conveyed at its close, which in the second stanza should rise to utter scorn.

In the third stanza the spirit is one of lofty irony, saddening somewhat as its last lines are reached.

In stanza four the loftiness of thought remains, but the irony has given way to what is almost pity for the decrepitude of the realms of man as contrasted with the immortal youth of the Ocean.

Then follows the mighty apostrophe to Ocean as the mirror of the Almighty, the image of Eternity, the throne of the Invisible, which can only be fitly given by absolute regard to simplicity, gravity, and dignity of utterance. The utmost height of this great ode has been reached—the fullest sweep of its majestic tide; the last verse sinks from the divine to the human, from sublimity to sympathy; and this very refluence is a relief to the mind, that cannot but have been awe-stricken at the sudden accumulation of such stupendous images.

It is easy, therefore, to pass into a more quiet mood, and even to close with an expression of familiar affection.

[1] *Save his own*, his own ravage or destruction.
[2] *Unknelled*, without a bell to toll for him.
[3] *And howling to his gods, etc.* This may be paraphrased: Thou sendest him crying aloud to Heaven, to the harbour in which his sorry hope of refuge lies, and tossest up his corpse upon the shore. *Lay*, here incorrectly used for lie.
[4] *The armaments which thunder-strike* (poetical for 'fire their cannon upon').
[5] *The oak leviathans*, gigantic vessels of oak.
[6] *Their clay creator*, man.
[7] *Lord of thee*, lord of the sea.
[8] *Arbiter of war*, one who can decide war's issues.
[9] *Thy yeast of waves*, the ferment of thy waves.
[10] *Which mar alike the Armada's pride.* The bulk of the Spanish Armada, after meeting defeat at the hands of the English, suffered shipwreck on the Scotch and Irish coasts.
[11] *Or spoils of Trafalgar.* After Nelson's last victory a severe storm overwhelmed many of the French vessels captured in the engagement.
[12] *Assyria, Greece, Rome, Carthage.* All great naval empires, whose fleets suffered disastrously from tempests.
[13] *I wantoned with thy breakers*, playfully dived under and rode over them. Lord Byron was a fine swimmer. Amongst other feats, he swam the Hellespont.

One Hundred Lines and more for Third Year Pupil Teachers.

THE FORSAKEN MERMAN.

BY MATTHEW ARNOLD.

ARGUMENT.

[A mortal maiden has married a merman, one of the kings of the sea. She is happy with her husband and children, at least, so it seems; till as she sits with them upon a golden throne in the heart of the ocean combing the bright hair of her youngest child, the far-off sound of the Easter bells upon the shore swing down upon her hearing. She sighs, and beseeches the merman to let her join her kinsfolk in prayer at that holy time, lest she should lose her soul. Her wish is readily granted by her husband, for he believes her true, and that she will quickly return to him and her babes. But they watch in vain for her return and seek her in vain upon the shore, and at last return broken-hearted to their home in the ocean, the forsaken merman telling his story and lamenting his loss in the following beautiful words.]

COME, dear children, let us away,
Down and away below!
Now my brothers call from the bay;
Now the great winds shorewards blow;
Now the salt tides seawards flow;
Now the wild white horses[1] play,
Champ and chafe and toss in the spray.
Children dear, let us away!
This way, this way!

Call her once before you go—
  Call once yet!
In a voice that she will know:
  'Margaret! Margaret!'
Children's voices should be dear
(Call once more) to a mother's ear;
Children's voices wild with pain—
Surely she will come again!
Call her once, and come away;
This way, this way!
'Mother dear, we cannot stay!'
The wild horses foam and fret,
Margaret! Margaret!
Come, dear children, come away down;
  Call no more!
One last look at the white-walled town
And the little grey church on the windy shore,
  Then come down!
She will not come though you call all day.
Come away, come away!

Children dear, was it yesterday
We heard the sweet bells over the bay,
In the caverns where we lay,
Through the surf and through the swell,
The far-off sound of a silver bell—
Sand-strewn caverns, cool and deep,
Where the winds are all asleep;
Where the spent lights[2] quiver and gleam;
Where the salt-weed[3] sways in the stream;
Where the sea-beasts ranged all round
Feed in the ooze[4] of their pasture-ground;

Where the sea-snakes coil and twine,
Dry their mail[5] and bask in the brine;
Where great whales come sailing by,
Sail and sail with unshut eye,
Round the world for ever and aye;
When did music[6] come this way?
Children dear, was it yesterday?

Children dear, was it yesterday
(Call yet once) that she went away?
Once she sat with you and me,
On a red gold throne in the heart of the sea,
And the youngest sate on her knee.
She combed its bright hair and tended it well
When down swung the sound of the far-off bell.
She sighed, she looked up through the clear
  green sea.
She said, 'I must go, for my kinsfolk pray
In the little grey church on the shore to-day.
'Twill be Easter-time in the world, ah me!
And I lose my poor soul,[7] merman, here with
  thee.'
I said, 'Go up, dear heart, through the waves;
Say thy prayer and come back to the kind sea-
  caves.'
She smiled, she went up through the surf in the
  bay.
Children dear, was it yesterday?
Children dear, were we long alone?
'The sea grows stormy,' the little ones moan.
'Long prayers,' I said, 'in the world they say.
Come!' I said, and we rose through the surf[8] in
  the bay.
We went up the beach by the sandy down,
Where the sea stocks bloom, to the white-walled
  town,
Through the narrow, paved streets, where all was
  still,
To the little grey church on the windy hill.
From the church came a murmur of folk at their
  prayers,
But we stood without in the cold blowing airs.
We climbed on the graves, on the stones worn
  with rains,
And we gazed up the aisle through the small
  leaded panes.[9]

She sate by the pillar; we saw her clear:
'Margaret, hist! come quick, we are here.
Dear heart,' I said, 'we are long alone.
The sea grows stormy, the little ones moan.'
But oh, she never gave me a look,
For her eyes were sealed to the holy book!
'Loud prays the priest; shut stands the door.

[1] *The wild white horses*, the billows foaming on shore.
[2] *The spent lights*, the light of the sun which had spent its force passing through the deep sea.
[3] *The salt weed*, the sea weed.
[4] *The ooze*, the rich mud.
[5] *Their mail*, their skins bright as polished mail or armour.
[6] *When did music*, etc., *i.e.*, the sound of the Easter bell.
[7] '*And I lose my poor soul.*' A superstition prevailed that mermen and mermaids existed for ages, but that they were without souls, and could not therefore win salvation. Margaret feared that by neglecting her religion she would share this fate.
[8] *The surf*, the foam produced by waves breaking over rough ground.
[9] *The small leaded panes*, small, square or diamond-shaped panes, separated from each other by leaden bars.

Come away, children; call no more!
Come away, come down; call no more!'

Down, down, down!
Down to the depths of the sea!
She sits at her wheel[10] in the humming town,
Singing most joyfully.
Hark what she sings: 'O joy, O joy,
For the humming street, and the child with its toy,
For the priest, and the bell, and the holy well[11]—
For the wheel where I spun,
And the blessed light of the sun.'
And so she sings her fill,
Singing most joyfully,
Till the shuttle[12] falls from her hand,
And the whizzing wheel stands still.
She steals to the window and looks at the sand;
And over the sand at the sea;
And her eyes are set in a stare;
And anon there breaks a sigh,
And anon there drops a tear,
From a sorrow-clouded eye
And a heart sorrow-laden,
A long, long sigh;
For the cold strange eyes of a little mermaiden,
And the gleam of her golden hair.

Come away, away, children;
Come, children, come down!
The hoarse wind blows colder;
Lights shine in the town.
She will start from her slumber
When gusts shake the door.
She will hear the waves howling,
Will hear the waves roar.
We shall see, while above us
The waves roar and whirl,
A ceiling of amber,[13]
A pavement of pearl,
Singing, 'Here came a mortal,
But faithless was she,
And alone dwell for ever
The kings of the sea.'

But, children, at midnight
When soft the winds blow,
When clear falls the moonlight,
When spring-tides[14] are low:
When sweet airs[15] come seaward
From heaths starred with broom,
And high rocks throw mildly
On the blanched[16] sands a gloom;
Up the still glistening[17] reaches,
Up the creeks[18] we will hie,[19]
Over banks of bright sea-weed
The ebb-tide[20] leaves dry.
We will gaze from the sand-hills
At the white, sleeping town;
At the church on the hill-side—
And then come back down;
Singing, 'There dwells a loved one,
But cruel is she!
She left lonely for ever
The kings of the sea.'

[10] *Her wheel*, her spinning-wheel.
[11] *The holy well.* Wells blessed by saints, or held to be consecrated by other causes, are still held sacred by Roman Catholics, and believed to work miraculous cures upon the sick and diseased.
[12] *The shuttle*, an instrument used in weaving.
[13] *Amber.* A yellow glutinous material cast up by the sea, with electrical properties, and hence called electrum by the ancients, which hardens into a beautiful transparent substance highly prized for carving purposes.
[14] *Spring-tides*, the highest rising and furthest falling tides, caused by the united attraction of the sun and moon.
[15] *When sweet airs*, etc., when breezes sweet with the mingled scent of the heather and the broom—whose blossoms shine like golden stars upon the heath—come seawards.
[16] *Blanched*, whitened.
[17] *Glistening*, with a liquid gleam upon them.
[18] *Creeks*, narrow inlets.
[19] *Hie*, hasten.
[20] *The ebb-tide*, the ebbing or retreating tide.

NOTE UPON THE RECITATION OF THE PIECE.

This subject is so exquisitely simple that it calls for but few hints as regards the recitation of it. The voice should be sadly raised just a little when the lost wife and mother is called in the first and second verses. The third verse should be repeated in a dreamy, musing tone, with a note of uncertainty in it, which gives way to deep pathos when the happy sea-group is invaded by the sound of the Easter bells, and the merman trustfully allows his Margaret to return to earth awhile. Growing impatience, subdued, however, by the stillness and solemnity on shore, and dying into despair as the merman fails to win his wife back to him from 'the holy book,' characterizes the next verse. In the succeeding verse the variation of Margaret's mood might be indicated with the more effect by dropping the voice somewhat, and dwelling a good deal on the last two lines. The next verse should be taken very slowly and sadly. The last stanza but one should be given more rapidly, as its movement depicts stormy and passionate feelings; but the final verse should be rendered slowly, softly, and tenderly, for though lost for ever, the cruel one is still for ever beloved.

For Pupil Teachers at end of Fourth Year, 53 lines of Shakspere and 52 of Milton.

'PORTIA'S APPEAL TO SHYLOCK.'

From the Trial Scene in 'The Merchant of Venice,' by William Shakspere.

[Portia disguised as a lawyer, pleads for the life of Antonio, her lover Bassanio's friend, before the Duke of Venice.]

THE quality of mercy is not strained;[1]
It droppeth, as the gentle dew from heaven
Upon the place beneath: it is twice blessed;
It blesseth him that gives, and him that takes;
'Tis mightiest in the mightiest; it becomes[2]
The thronèd monarch better than his crown.
His sceptre shows the force of temporal power,
The attribute to[3] awe and majesty,
Wherein doth sit the dread and fear of kings,
But mercy is above this sceptred sway,
It is enthronèd in the hearts of kings,
It is an attribute to God Himself;

[1] *The quality of mercy is not strained, i.e.*, it is not doled out drop by drop; but overflows in full measure.
[2] *It becomes*, suits temporal power, as opposed to Divine power. Temporal means *for a time*, as opposed to *Eternal.*
[3] *The attribute to*, what is attributed to or belongs to. We should say 'an attribute of.'

And earthly power doth then show likest God's,
When mercy seasons[4] justice. Therefore, Jew,
Though justice be thy plea, consider this—
That in the course of justice[5] none of us
Should see salvation: we do pray for mercy;
And that same prayer doth teach us all to render[6]
The deeds of mercy.

NOTE.

A tenderness of tone exalted to awe, and again descending to a human note, is the key to a right recitation of this inimitable passage.

[4] *Seasons*, tempers.
[5] *In the course of justice*, should we be judged strictly according to our deserts.
[6] *To render, i.e.*, to extend to others.

A SONNET.

BY WILLIAM SHAKSPERE.

'There are two cardinal laws of the sonnet, which demand that it shall consist of fourteen rhymed decasyllabic lines, and be a development of one idea, mood, feeling, or sentiment—and one only.'—DAVID MAIN.

LET me not to the marriage[1] of true minds
Admit impediments. Love is not love
Which alters,[2] when it alteration finds,
Or bends with the remover to remove.
O no! it is an ever-fixèd mark,[3]
That looks on tempests and is never shaken;
It is the star[4] to every wandering bark,
Whose worth's unknown, although his height be taken.
Love's not Time's fool,[5] though rosy lips and cheeks
Within his bending sickle's[6] compass come;
Love alters not with his brief hours[7] and weeks,
But bears it out[8] even to the edge of doom.
If this be error, and upon me proved,
I never writ,[9] nor[10] no man ever loved.

NOTE.

The first eight lines should be given with an expression of ardent conviction, 'whose worth's unknown,' being its culminating note. The next four lines should be repeated with a quiet, earnest subsidence of tone. Then after a pause the closing couplet should be spoken with strong emphasis, just touched with irony.

[1] *The marriage*, the continual union.
[2] *Which alters,.....or bends*, which when the object of affection alters or is removed, alters or is removed also.
[3] *An ever-fixèd mark*, a landmark for storm-driven vessels to steer by.
[4] *The star*, the Pole Star, whose value is priceless, though its altitude is gauged.
[5] *Time's fool, i.e.*, the mere sport of Time.
[6] *His bending sickle.* Time is pictured with a scythe owing to his destructive power over all human things.
[7] *His brief hours*, Time's.
[8] *Bears it out*, endures, *to the edge of doom*, till the day of doom or judgment is reached.
[9] *Writ*, old English for 'wrote.'
[10] *Nor no man*, we should say 'and no man.' The double negative, which is now vulgar, was once correct and used to imply a strong emphasis.

THE CHARACTER OF CARDINAL WOLSEY.

From Shakspere's 'Henry VIII.' Act V., Scene 2.

Griffith.— This Cardinal,
Though from an humble stock,[1] undoubtedly
Was fashioned to[2] much honour from his cradle.
He was a scholar, and a ripe and good one;
Exceeding wise, fair spoken,[3] and persuading;[4]
Lofty and sour, to them that loved him not;
But, to those men that sought him, sweet as summer,
And though he were unsatisfied in getting,[5]
(Which was a sin,) yet, in bestowing, madam,[6]
He was most princely; ever witness[7] for him
Those twins of learning, that he raised in you,
Ipswich and Oxford! one of which fell with him,
Unwilling to outlive the good that did it;[8]
The other, though unfinished, yet so famous,
So excellent in art, and still so rising,[9]
That Christendom shall ever speak his virtue.
His overthrow heaped happiness upon him;
For then, and not till then, he felt himself,
And found the blessedness of being little;
And, to add greater honour to his age
Than man could give him, he died fearing God.

NOTE.

The recitation of this passage calls for little suggestion. Griffith is addressing Queen Catherine, and so there should be an air of respect in the deliverance of this eulogy of her enemy, but beyond this a tone of unaffected admiration and regret for the death of a great man is all that is called for, coupled in the last five lines with an indication of complete submissiveness on Wolsey's part to the will of God.

[1] *From an humble stock*, said to have been a butcher's son at Ipswich.
[2] *Was fashioned to*, educated to, his character formed for.
[3] *Fair spoken*, with a good address.
[4] *Persuading*, persuasive.
[5] *Unsatisfied with getting*, ambitious, a fault which he himself deplores in his famous farewell to Thomas Cromwell.
[6] *Madam*, Griffith is addressing Queen Catherine of Arragon.
[7] *Ever witness.* Ye twin seats of learning, Ipswich and Oxford, always bear witness in his favour.
'His school at Ipswich was eclipsed by the glories of his foundation at Oxford, whose name of Cardinal College has been lost in its later title of Christ Church.' J. R. Green's 'Short History of the English People,' page 317.
[8] *The good that did it*, the good man who created it.
[9] *So excellent in art and still so rising*, so beautiful in its architecture as far as it has been built, and giving such promise of further beauty.

TO THE NIGHTINGALE.

A SONNET BY JOHN MILTON.

O NIGHTINGALE, that on yon bloomy spray
Warblest at eve, when all the woods are still,
Thou with fresh hope the lover's heart dost fill,
While the jolly hours[1] lead on propitious May.[2]
Thy liquid notes that close the eye of day,[3]

[1] *The jolly hours*, the beautiful hours. Jolly had this, the French sense of the word, originally.
[2] *Propitious May.* May that promises well.
[3] *That close the eye of day*, that are heard first at sundown.

First heard[4] before the shallow cuckoo's bill,
Portend success in love; oh, if Jove's will[5]
Had linked that amorous power[6] to thy soft lay,
Now timely sing,[7] ere the rude bird of hate[8]
Foretell my hopeless doom in some grove nigh;
As thou from year to year hast sung too late
For my relief, yet hadst no reason why:
Whether the Muse,[9] or Love, call thee his mate,
Both them I serve, and of their train am I.

NOTE.

Passionate entreaty, tinged with pathos and relieved by playfulness, are the characteristics of the piece to which the attention of the reciter is drawn.

[4] *First heard.* The nightingale's song, if heard before the cuckoo's note, was supposed to *portend*, foretell, success in love.
[5] *Jove's will*, the will of Jupiter, the chief of the gods.
[6] *That amorous power, i.e.*, the power to foretell success in love.
[7] *Timely sing, i.e.*, in good time.
[8] *The rude bird of hate*, the cuckoo, whose voice, if heard before the nightingale's, would portend disappointment in love.
[9] *The Muse*, the Spirit of Poetry. The last two lines imply that as the nightingale is either the companion of Poesy or Love, and he is the servant of both, the bird has it in her power to plead with one or other of these powers on his behalf.

ON HIS BEING ARRIVED AT THE AGE OF TWENTY-THREE.

A SONNET BY JOHN MILTON.

How soon hath Time, the subtle thief of youth,
Stolen on his wing my three-and-twentieth year!
My hasting days fly on with full career,
But my late spring[1] no bud or blossom shew'th;
Perhaps my semblance might deceive the truth,[2]
That I to manhood am arrived so near.
And inward ripeness[3] doth much less appear,
That some more timely happy spirits endu'th.[4]
Yet be it less or more,[5] or soon or slow,
It shall be still in strictest measure even
To that same lot, however mean or high,
Toward which Time leads me, and the will of Heaven;
All is, if I have grace to use it so,
As ever[6] in my great Task-Master's eye.

NOTE.

The first eight lines should be given with a certain degree of despondency; but with the ninth there should arise an expression indicating the resolution of the poet to do his duty in the state of life to which God has called him, whatever it may prove to be.

[1] *My late spring, etc.* The spring, or promise of moral excellence in him.
[2] *My semblance might deceive the truth.* Milton was remarkably youthful-looking at this age; indeed, owing to his smooth skin, fine features, and the long curls, which it was at the time the fashion for men to wear, he looked more like a beautiful woman than a youth.
[3] *Inward ripeness*, ripeness of the soul and reason.
[4] *That some more timely-happy spirits endu'th*, which endues some spirits more early favoured (with such heavenly fruit) than myself.
[5] *Yet be it less or more, etc.* This passage may be thus paraphrased:—'Yet though my final fruition be little or large, early or late, it shall be in strict consonance with that lot, however mean or high, towards which time and God's will are leading me.' He will be true to himself, whatever Providence has in store for him.
[6] *All is . . . as ever.* 'Everything I do shall be done as it ever has been, in the sight of Heaven, if I but have the grace given me thus to use my powers.'

ON HIS BLINDNESS.

A SONNET BY JOHN MILTON.

When I consider how my light is spent
Ere half my days,[1] in this dark world and wide,
And that one talent[2] which is death to hide
Lodged with me useless, though my soul more bent[3]
To serve therewith my Maker and present
My true account, lest He returning chide.
Doth God exact day-labour, light denied?
I fondly ask.[4] But Patience, to prevent
That murmur, soon replies, God doth not need
Either man's work or His own gifts; who best
Bear His mild yoke,[5] they serve Him best: His state
Is kingly; thousands at His bidding speed,
And post[6] o'er land and ocean without rest;
They also serve who only stand[7] and wait.

NOTES.

Milton's blindness was evidently brought on by excessive study at the University, and for many years after, as a scholar and author, and Latin Secretary to the Commonwealth.

Bishop Newton writes of him that 'his eyes were of a light blue colour, and from the first were none of the brightest, but after he lost his sight of them they still appeared without spot or blemish, and at first view and at a little distance, it was not easy to know that he was blind.'

This poem should be started with an accent of some impatience, great care being taken to give just emphasis to the subordinate clauses and sentences till the seventh line is reached, when the voice should be 'lifted' upon the enquiry there contained. The second half of the sonnet, or the answer of Patience, should be calmly rendered, the co-ordinate sentences given with quiet firmness, the delivery quickening in lines 12 and 13 to suit the action, when there should be a pause to give more effect to the perfect submissiveness of attitude expressed in the last line.

[1] *Ere half my days.* Milton was about forty-three at the time. He lived twenty-two years longer.
[2] *That one talent.* That of an author. An allusion is made to the Parable in Matthew xxv.
[3] *Though my soul more bent....* Though my soul being more bent.
[4] *I fondly ask.* Notice the inverted construction. The passage means 'I fondly ask, Doth God exact day-labour from one to whom light is denied (through blindness)?'
[5] *His mild yoke.* 'My yoke is easy.'
[6] *Post* = hasten.
[7] '*They also serve who only stand and wait.*' This beautiful line has become proverbial.

SONG ON MAY MORNING.

BY JOHN MILTON.

Now the bright morning star, day's harbinger,[1]
Comes dancing[2] from the east, and leads with her
The flowery May, who from her green lap throws
The yellow cowslip and the pale primrose.
Hail, bounteous May, that dost inspire
Mirth and youth and warm desire;[3]

[1] *Harbinger*, foreteller, herald.
[2] *Dancing*, its rays sparkling so that it appears to dance—a beautiful image.
[3] *Warm desire*, warm affection.

Woods and groves are of thy dressing,
Hill and dale doth boast thy blessing.
Thus we salute thee with our early song,
And welcome thee, and wish thee long.[4]

NOTE.

This song should be given in a happy tone, the first four lines being taken somewhat more rapidly than the four succeeding ones, and a slight pause being allowed at the end of the eighth line.

[4] *Wish thee long.* Wish a long continuance of May time.

Lessons in English.

BY ALEXANDER BAIN, LL.D.

VI.—EMOTIONAL QUALITIES.

I HAVE already brought to view the quality of Impressiveness, as having both an intellectual and an emotional bearing. The less ambiguously Emotional qualities must now be exemplified.

A preparatory scheme of these Qualities is essential as a basis: which scheme must be expressed in terms of our emotional nature. Various modes of laying out the subject might be suggested; and, as there is no space for discussing the merits of the respective proposals, we must be content with such an outline as shall supply an adequate terminology for the analysis that is to follow.

The full compass of Poetical criticism ranges over Figures of Speech, Emotional Qualities, and Poetic Arts; the three not being entirely separable; but all being necessary for our purpose. The Figures I do not propose to classify; the more important of them are familiar to pupils of the Higher Composition. The Emotional Qualities (more or less implicated in the Figures) are not so easy to specify and define.

Sublimity, Beauty, Wit and Humour, Melody, Harmony, Picturesqueness,—are received designations for emotional qualities. A slight modification of these, accompanied with suitable explanations or definitions, is what we will now attempt.

The Human Feelings are either Sensations or Emotions. Our sensations are a great source of our pleasures, but only a part of these can be introduced into Art. The pleasures of sight and hearing are the most elevated: and the ideas of these enter largely into poetry, as pictures to the imagination, and language to the ear. In their most simple, or uncombined forms, these are the sensuous effects of poetry.

Next are the Emotions: of which two classes are fundamental, and very nearly exhaust our emotional nature; the one class, the Irascible or malevolent group; the other the Amicable, loving, or benevolent. The influence of these comes out in direct and unmistakable forms; and also in many subtle transformations, not always easy to trace. By virtue of a class of objects that face both ways at once, there is a kind of transition from the one to the other, notwithstanding their widely opposite nature.

The malignant passion may be expressed as the human survival of the passion for prey in the lower animals. It gives a positive delight in the sufferings of other beings, although there are usually certain disguises or pretexts whereby we justify to ourselves the infliction of suffering. Revenge is the most usual manifestation of this form of delight.

The counter passion of Love and Benevolence is also a grand source of pleasure, and is largely involved in all the productions of Art. Through it we take delight in representations of love and goodness; these show Art in its most humanising form.

The Emotion termed Sublimity is connected with vastness of Power; which sometimes takes the form of maleficent power, and sometimes of beneficent; while at other times, it is simply a possibility of one or the other. In parsing for the quality of Sublimity in style, we should make the distinction as far as we are able.

The effect called Pathos belongs exclusively to the Tender, Amicable, or Loving Emotion. Its most representative aspect comes out when we make use of the Emotion as a means of soothing and consoling the mind under pain. The Beautiful, in a somewhat narrow sense, and in contrast to the Sublime, is concerned with the manifestations of Tender Feeling. In a wider sense, Beauty, or the Beautiful, is co-extensive with Fine Art as a whole.

A scale of the effects growing out of the two grand master passions, may be drawn thus:—

1. Malignant Revenge.
2. Righteous Indignation.
3. Maleficent Power, or the Sublime of Destruction.
4. Power, as vast possibility simply.
5. Beneficent Power, marked by conquest of enemies.
6. Power of Constructive Beneficence; doing good on a grand scale without destructive or maleficent accompaniments.
7. Love, as Active.
8. Affection, simply as such.
9. Sorrow and Pathos.

In a systematic course of Rhetoric, these would be all exemplified *seriatim;* and to pupils of advanced classes, they would readily become intelligible. They present a gradation from Sublimity to Pathos, and show intermediate stages partaking of both qualities; it being a possibility of the mind to entertain at once the two opposite modes of feeling, by merely presenting them in different connections. Each of the two classes has its pleasures, and a mixed

glow is producible through their being skilfully combined, or, at all events, rapidly alternated.

Humour and the Comic are supposed to be based on our malevolent feelings, qualified and transformed by subtle arts, and by an admixture of the amicable passion. We shall not attempt, in the present short series of lessons, to deal (beyond a slight occasional allusion) with this peculiar class of effects; we have enough to occupy us in endeavouring to analyse the serious qualities.

The arts that render language itself, as addressing the ear, a source of charm, are not difficult to reduce to rule or law. We shall be content with adverting to marked instances of the effect.

In Poetry, images, individually operating on our strong feelings, are accumulated in masses, for still greater effect. But cumulation or combination gives opportunity for the highest art of the poet, which is to *harmonise* all the different influences that come together at the same time. Harmony is a thing of many degrees; and its appreciation is an admirable exercise, preparing the pupil for the highest strokes of the critical art. Nor is it beyond the powers of such pupils as are expected to profit by readings in Chaucer, Shakespeare, or Milton.

Without dwelling farther in generalities, let us take, as an exercise, Campbell's "Ode to the Rainbow,"—a fine example of poetic qualities:—

> Triumphal arch that fill'st the sky,
> When storms prepare to part!
> I ask not proud philosophy
> To teach me what thou art.

The two first lines contain an image of great sublimity, referring to one of the grandest objects of nature. The poetic art lies in providing a verbal expression that recalls the original, and heightens the effect by an apt comparison, and a well-chosen adjunct. The metaphor—"triumphal arch"—heightens the sublimity by the feelings associated with victory, the foundation of which is our maleficent emotions; augmented by various other well-known circumstances of delight. There is thus introduced an effective touch of genuine sublimity. The associated circumstance—"When storms prepare to part"—is a continuation of the same effect. The feeling associated with storms is the sentiment of power as destructive energy. The poet selects these two heightening expressions as his first effort at a poetic rendering of his subject. He does not adhere to this view in the remainder of the poem, as we shall see.

The second couplet—"I ask not proud philosophy"—is an innuendo, setting forth the superiority of poetry to science, which the poet expands in a subsequent stanza. The phrase "proud philosophy" might illustrate the heightening of an inanimate subject by a personifying metaphor—"proud": a word with a certain dignified, lofty meaning, but here used in a depreciatory sense, which the word also bears, when the pride is unjustifiable or undeserved; the effect then is a touch of scorn or contempt, a feeling coming within the compass of poetry, by the scope given to our malevolent passion.

We can here make use of the phrase—"When storms prepare to part"—as an illustration of the legitimate paraphrasing of poetic language. When, for the sake of effect, a poet departs from the prose form of expression, we may make it an exercise to reproduce that form in the best possible way; excellence of rendering being never lost sight of. In prose, we should have to turn the idea differently: the verb "to part" is clearly a poetic licence. There are many good expressions in familiar use:—"When storms are brewing"; "when a storm is gathering, impending, about to break or to burst"—and so on.

The second stanza is—

> Still seems, as to my childhood's sight,
> A midway station given
> For happy spirits to alight
> Betwixt the earth and heaven.

The poet now passes from the rendering of sublimity, so effective in the previous stanza, and here evokes the tender and pathetic feeling, which is sustained throughout several of the subsequent stanzas. The object is naturally sublime from its magnitude; yet poetry is not content with ringing the changes on the one principal quality of anything, provided other effects can be superinduced. The sublime and the pathetic carry the mind in different directions, but we can alternate from one to the other without undue violence to our feelings.

The phrase, "my childhood's sight," transports us back to the simplicity and fondness of our early years, yields a poetical effect of the nature of pathetic or tender feeling. This is carried out in the idea of the two last lines—"for happy spirits to pass between earth and heaven." A picture of celestial bliss necessarily engages our soft affections and pleasing emotions. The danger now is to keep clear of the maudlin, which we readily run into, when affection is iterated in hacknied phraseology. The poet is more successful in some of the other stanzas, where his originality has a redeeming power.

> Can all that optics teach unfold
> Thy form to please me so,
> As when I dreamt of gems and gold
> Hid in thy radiant bow?

Here there is a carrying out of the notion started in the first stanzas, namely, the inferiority of science to poetry or feeling in the handling of nature. The introduction of the contrast is perhaps the only questionable thing in the ode. There is no need to disparage science in order to elevate poetry; each stands on its own independent merits, and a poet should rather avoid

than seek occasion of quarrel. He must evoke the malign passions occasionally, in order to sound all the notes of our emotional nature; but more suitable subjects should be found than the scientific mode of viewing the world, even though that mode has sometimes a disenchanting effect. The two first lines might be dispensed with, and the two last might then run on—

'Twas then I dreamt of gems and gold
Hid in thy radiant bow.

The continuation of the fancy of childhood is well sustained by the choice of the glittering objects —gems and gold—and by the kindred metaphor "radiant," which brings to view an attribute of the sun—the sublimest object of the physical world.

The fourth stanza carries on the strife between poetry and science; the force and elevation of the language going far to atone for the unseemliness of the quarrel.

When science from Creation's face
Enchantment's veil withdraws,
What lovely visions yield their place
To cold material laws.

"Creation's face" belongs to the language of the sublime, from the comprehensiveness of the word, and the personification implied in it. "Enchantment's veil" expresses a high intensity of human pleasure, and is, from that cause, pleasing, if not vulgarised by a commonplace setting. "Lovely visions" also expresses delight, and is eminently poetic, being the poetry of our affectionate nature. The final touch—"cold material laws" gives us a kind of shudder, and is of itself a disagreeable suggestion, but for the use made of it, namely, to excite a burst of indignation against science. The objection to the whole is that we cannot work ourselves up into a sense of the injury done us by science, sufficient to justify a copious and luxurious outburst of indignant passion. In the conjunction, "cold material," there is a harmonious fitting of the two words, arising from the kindred emotional meanings: and harmony is always poetic.

The fifth stanza takes a higher flight—

And yet, fair bow, no fabling dreams,
But words of the Most High,
Have told why first thy robe of beams
Was woven in the sky.

Several of the arts of elevated style can here be exemplified. The bold Apostrophe is the setting of the whole. The strain is not markedly sublime, and not markedly pathetic or tender; it is the energetic assertion of a truth, enhanced by the power of contrast, and rendered touching by the emotional force of the several epithets employed. The opinion so strongly maintained is not very fortunate, seeing that it refers to one of the oldest difficulties in the Mosaic narrative, which has never been satisfactorily cleared up. Poets have no right to dogmatise where competent authorities express doubt; but, waving this objection, the stanza is a masterpiece of language; and every point admits of being rendered illustrative. The energetic contrast, "no fabling dreams" heightens the force of the assertion; and it is a case where contrast is not superfluous. The fine figure in the two last lines can be studied as an elegant and elevating similitude. The phrase "words of the Most High" as a figure for the Bible record, is in itself grand, and is brought in so as to avoid the tameness of familiarity.

When o'er the green undeluged earth
Heaven's cov'nant then didst shine,
How came the world's gray fathers forth
To watch thy sacred sign!

The poet here turns our thoughts to the significance of the bow, as an assurance against the re-flooding of the earth; and sets forth a poetic circumstance yielding the pathos of devout feeling. The most venerable representatives of the race, after the flood, "the world's gray fathers," are summoned to do homage to the sign. "The green undeluged earth" is a poetic condensation, which may be expanded in prose—"When thou didst shine, as Heaven's covenant, o'er the green earth, never again to come under a deluge—to be flooded." The epithet "sacred" chimes in with the general effect.

And when its yellow lustre smiled
O'er mountains yet untrod,
Each mother held aloft her child
To bless the bow of God.

A new picture is here given made up of epithets and circumstances, intended to enhance the glory of the object, and to make still farther use of the pathos of devoutness and gratitude. The combination "yellow lustre smiled" is somewhat forced, but yet within the licence of poetry. The action of smiling would, no doubt, be better suited by something more personal than yellow lustre; but the emotional meanings of the words are not in any way discordant. The circumstance—"O'er mountains yet untrod"—may be supposed to refer to the time immediately succeeding the flood, when the repeopling of the earth had proceeded a very little way—an inference that does not at once disclose itself. The more obvious suggestion of mountain solitudes would not conspire to the intended effect. The figure of the two last lines has undoubtedly the beauty of pathos, but does not add much to the effect of the "gray fathers" in the previous stanza. A bolder and more successful flight awaits us in the next stanza.

Methinks thy jubilee to keep,
The first-made anthem rang
On earth, delivered from the deep,
And the first poet sang.

Bating the extravagance of the sentiment, the stanza is very grand, both from the ring of the language and the choice of the circumstances.

It is a little absurd to suppose that, for fifty years, the thoughts of men had only one stirring topic, namely, the avoidance of another deluge; that there was nothing besides to furnish inspiration to poetry: still, the choice of circumstances contributes to heighten the grandeur of the subject, provided only we do not begin to feel that it is overdone. The poet himself does not feel so, for he grows warmer with his theme, and rises to a still higher flight in the stanza that follows.

Nor ever shall the muse's eye
Unraptured greet thy beam:
Theme of primeval prophecy,
Be still the poet's theme!

The loftiness of this sentence arises from the strain of exultation of the poet, drawing upon the dignity and greatness of his art, and expressing it by choice and compact language. We hear of the "Muse" in the poetry of all ages: but it never loses its associations of dignity and charm. The personification in the two first lines is vivid and terse. The effect approaches the sublime, rather than the tender mood. The two last lines derive their force from the magniloquent reference ("primeval prophecy") to the old subject, the prediction to Noah, and from the bold apostrophe—"be still the poet's theme."

We have next two exquisite stanzas, cast out of the permanent adjuncts of the bow, and independent of the connection with the deluge.

The earth to thee her incense yields,
The lark thy welcome sings,
When, glitt'ring in the freshened fields,
The snowy mushroom springs.

The beauty here ranges with tender feeling. The selection of circumstances fitted to enter into harmonious combination is everything that a poet could wish. The first line is a poetic rendering of the vapour that is the first source of the rain; it is poetized by the metaphor "incense," redolent of perfume and associations of sacredness. The introduction of the lark is the addition of one of our permanent charms; having, if not a special adaptation to the occasion, at least a general coincidence of effect, when the rainbow is viewed on the side of beauty, rather than of sublimity. The two last lines gather in a new circumstance from the rain—the bursting out of the mushroom growths in the fields. If this incident were viewed in its naked aspect, it would fail to lend the expected agreeable additions to the grouping; but as expressed in the poet's phraseology ("glittering and snowy"), and dignified with his impressive metre, it answers his intentions in composing a group of heightening accompaniments to the main theme.

How glorious is thy girdle cast
O'er mountain, tower, and town,
Or mirrored in the ocean vast,
A thousand fathoms down!

A truly magnificent stanza: the sublimest in the piece. The figure—Exclamation, is the setting of the whole: (the verb "is" in the first line might be omitted in conformity with the usage of the figure). The sublime aspect of the rainbow, from its celestial dimensions and span, is here done justice to once more; improving upon the two first lines of the opening stanza. The vastness of the embrace is pictured forth by the choice of the most conspicuous and grand of the objects of the earth—"mountain, tower, and town;" a grouping which, if not a climax, neither is it an anticlimax: a town, in one view, has not the sublimity of the mountain, but it has a counterbalancing importance from its aggregate of objects and interests. But for the highly effective emphasis of the word as closing the line, "city" would be preferable from its greater dignity of associations: as in Milton's description from the mountain of temptation—"cities many and high-tower'd."

The two last lines bring in the ocean with greater effect, although with some licence of imagination. The wide ocean is one of our most sublime terrestrial objects; and its character in that respect is helped out by the powerful epithet "vast"; while the line has the poet's usual energy of metre. The "mirroring" is an expansion of the image of the bow, but unfortunately not true to fact in the ordinary state of the ocean's surface; the "thousand fathoms down" is a splendid expression for what might happen in a very rare moment.

The poet returns once more to the historical aspect of the bow; and embodies it with the poetic touches of the two concluding stanzas.

As fresh in yon horizon dark,
As young thy beauties seem,
As when the eagle from the ark
First sported in the beam.

This is legitimate poetic thought. The phenomena of the world that are naturally imperishable or undecaying can be placed in effective contrast with the numerous examples of decay that we are destined to experience. The negative of such a painful circumstance as perishability and mortality constitutes a high and impressive merit, and enters into our permanent phraseology of laudation. "The eagle from the ark" plays an expressive part, as did the previous introduction of the lark, contributing to the sublime aspect of the subject, which the poet handles alternately with the other.

For, faithful to its sacred page,
Heaven still rebuilds thy span,
Nor lets the type grow pale with age
That first spoke peace to man.

"Heaven" is here impressively endowed with its double function, namely, as the source of Bible inspiration, and as the prime mover of the natural world. The benign aspect of sublimity is well exemplified in the union of the different strains; while there is an iteration of the negative of decay, coupled with the benign reference to the goodness of Heaven as its cause.

Eminent Practical Teachers.

DAVID STOW,

Founder of the Training System of Education.

BY JOHN R. LANGLER, B.A., F.R.G.S.,

Of the Westminster Training College, Ex-President of the National Union of Elementary Teachers.

VI.

THE Sympathy of Numbers was recognised by Mr. Stow as a chief instrument in the intellectual advancement, and especially in the moral regeneration, of the people. 'Example, indeed, is more powerful than precept, but *sympathy* is more powerful than either, or both combined.' Forty years ago children had not even the negative advantage of compulsory attendance at school. They were not, during any portion of the day, deprived of the evil training of the streets, and their habits were being formed under the mighty influence of a *sympathy* which was then 'all on the side of evil.' To lay hold on this principle and turn it to good was, as we have seen, the object Mr. Stow had constantly in view, and the classification of children in distinct departments, the 'raised gallery,' the simultaneous method of instruction, and, particularly, the 'uncovered schoolroom,' were all devised by his untiring ingenuity to secure this desirable result. The Sympathy of Numbers is, of course, chiefly felt in large centres of population, and it was to our large towns that the Moral Training System was designed to be primarily and specially applicable. Children naturally associate for any pursuit, innocent or mischievous, with others of about the same age, rather than with those who are much older or much younger. Right precept—*mere* precept—is powerless in the presence of such association, when precept, example, and sympathy are united on the side of wrong. The 'trainer' who by his conduct secures the confidence and sympathy of his children can use this influence always in favour of what is right, and experience has confirmed the theory which Mr. Stow endeavoured to establish:—'The play-ground and the gallery conjoined, under proper management and superintendence, afford the most perfect sympathy.' This principle of our nature was utilised in the Glasgow System, not only in connection with moral training, but also, as before stated, in the intellectual processes. 'Teaching is not training' is the first fundamental principle of Stow's System, and the Sympathy of Numbers is the second. The oral training lessons, whilst they secure to infants and others unable to read a vast amount of intellectual instruction, at the same time tend to establish the sympathy which is held to be vital to the Moral Training System,

No one, however unacquainted he may have previously been with the principles now explained, will be surprised to find that Mr. Stow set the highest value on Infant Schools. 'You will acknowledge that the Infant or Initiatory School is not the lowest, but the highest in the scale. A man who makes a good infant trainer never fails in making a first-rate juvenile trainer. A rough gardener may raise coarse plants, but only an experienced one can be be trusted with exotics' (Hint 139). This point has been named in connection with the power of simplifying any subject of instruction. It must not, however, be understood from this quotation that men are to be preferred to women as trainers in Infant Schools. A 'Criticism Lesson in the Initiatory Department' was to all students the most dreaded, because the most difficult, test of true teaching power. Not a few graduates have quailed before the infants, who, in spite of all their efforts to make a point plain, 'wouldn't understand.' The mere scholar, unpractised in the art of teaching, could not present simple ideas in simple language, and many an amusing scene will readily recur to the memory of all who have witnessed such struggles. As about one-third of the children in our schools may be considered as infants, the importance of infant teachers to the community demands the attention which Mr. Stow always claimed for it.

In concluding this brief consideration of the character of the Training System, it may be well to remember that, unlike some schemes of education, it was not in its origin the practical application of some preconceived theory. It was developed by degrees during an effort to benefit, both morally and intellectually, the sunken masses. It was the result of the experience of a highly intelligent and strongly sympathetic Christian gentleman. The history of its development has been imperfectly sketched. We have also noticed, as the features of the system named 'distinctive' by Mr. Stow, the use of the Sympathy of Numbers for moral and intellectual purposes, the Bible and other oral training lessons, the 'picturing out in words,' and the systematic use of the 'uncovered schoolroom,' and of a 'raised gallery.' Reference has been made to some details of method which were adopted in daily school work.

It only remains to commend to all who are entering on the study of education, or who intend to become practical teachers, to read Mr. Stow's own work, 'The Training System.' For the student's purpose its arrangement might have been advantageously different, but every young teacher will nevertheless find in it hints of great and permanent value. The principles of the system are of general application, and 'results' such as have attracted the attention of philanthropists will doubtless follow wherever such training is adopted, These 'results,' however, cannot all be tabulated, and the most important of them are likely to be entirely overlooked. It is an unwelcome fact that at present mere mechanical results are often more highly valued than true educational work, which cannot ordinarily be recorded. It will not be so always.

Archimedes, in considering the power of the lever as a machine, is said to have exclaimed:

Δὸς ποῦ στῶ, καὶ τὴν γῆν κινήσω.

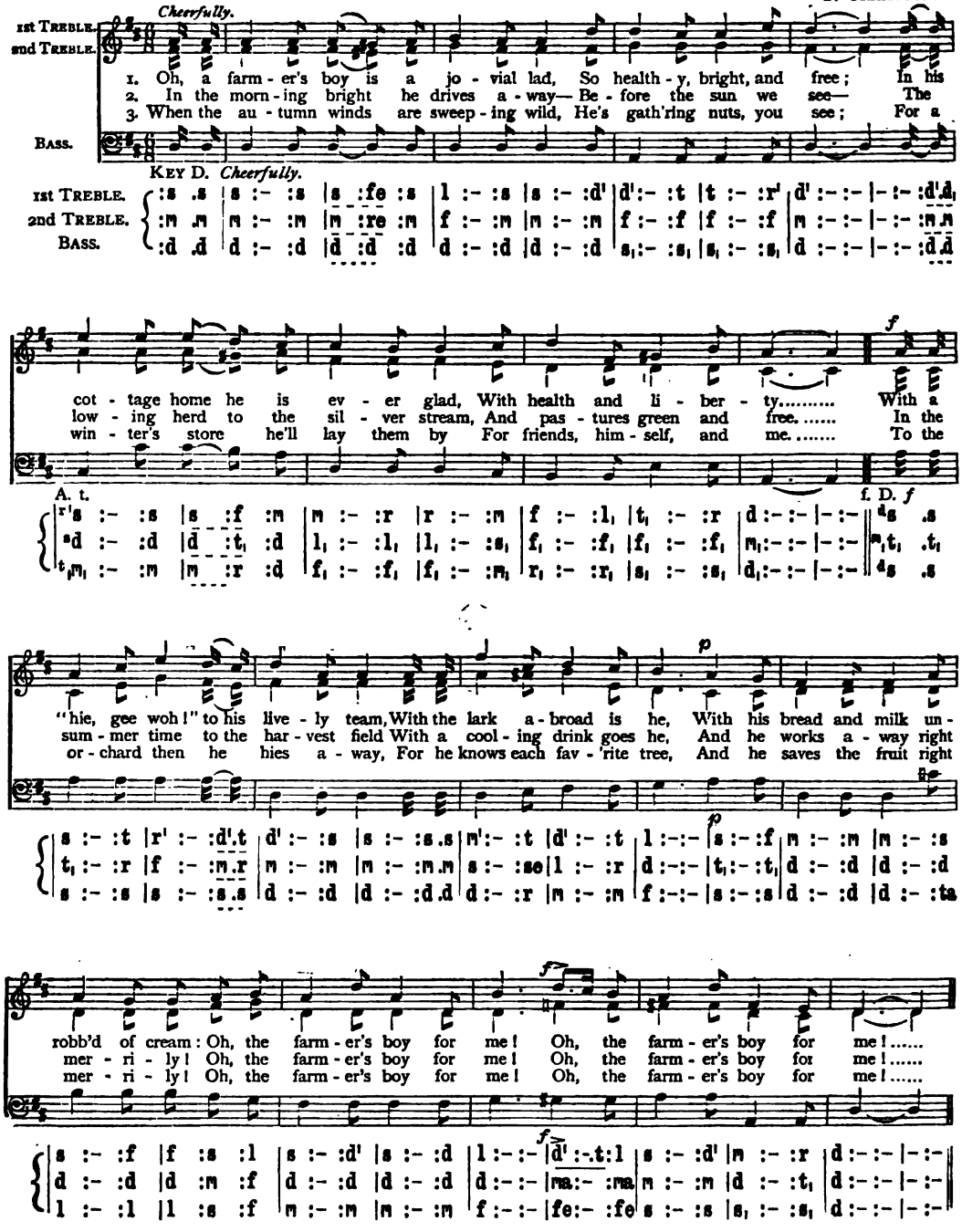
('Give me where I may stand (sto), and I will move the world.')

The name of the founder of the Training System recalled this enthusiastic outburst of the mechanician of Syracuse to the mind of the writer on the completion of his short course of training at Glasgow. With a similar enthusiasm fully shared by his fellow-students he entered on his work as a practical teacher, and he still believes that the Moral Training System, resting on the fulcrum of revealed truth, is a lever capable not only of raising the classes for whom it was first designed, but of lifting the whole community to a higher level of moral power and intellectual life.

—o—

THE FARMER'S BOY.

T. CRAMPTON.


1st TREBLE.
2nd TREBLE.
BASS.
Cheerfully.
1. Oh, a farm-er's boy is a jo-vial lad, So health-y, bright, and free; In his
2. In the morn-ing bright he drives a-way— Be-fore the sun we see— The
3. When the au-tumn winds are sweep-ing wild, He's gath'ring nuts, you see; For a
KEY D. Cheerfully.
cot-tage home he is ev-er glad, With health and li-ber-ty..... With a
low-ing herd to the sil-ver stream, And pas-tures green and free..... In the
win-ter's store he'll lay them by For friends, him-self, and me..... To the
"hie, gee woh!" to his live-ly team, With the lark a-broad is he, With his bread and milk un-
sum-mer time to the har-vest field With a cool-ing drink goes he, And he works a-way right
or-chard then he hies a-way, For he knows each fav-'rite tree, And he saves the fruit right
robb'd of cream: Oh, the farm-er's boy for me! Oh, the farm-er's boy for me!.....
mer-ri-ly! Oh, the farm-er's boy for me! Oh, the farm-er's boy for me!.....
mer-ri-ly! Oh, the farm-er's boy for me! Oh, the farm-er's boy for me!.....

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR FEBRUARY, 1883.

STANDARD IV.

A. 1. £1589 19s. 9¾d.
2. £38,400 15s. 7½d.
3. £43 14s. 1½d.—8.
B. 1. 172 t. 7 c. 3 q. 1 lb. 7 oz.
2. 1,092,960 in.
3. £782 1s. 5½d.—54.
C. 1. 1,975,617d.
2. 2,972,970 sq. ft.
3. £3923 2s. 5½d.
D. 1. 1 w. 1 d. 7 h. 7 m. 3 s.
2. £3,999 18s. 7½d.
3. £1 9s. 8¼d.

E. 1. £1 3s. 5¼d.
2. £53 17s. 9½d.—736.
3. £252 9s. 0¾d.
F. 1. 81 lb. 10 oz. 11 dwt. 1 gr.
2. 10s. 3¾d.
3. 223 cwt. 2 qr. 20 lb. 8 oz.

ADVANCED EXAMINATION.

1. 400 yds.
2. £15 11s. 3d.
3. 665 coats, 1 yd. 3 qr. 2 nl. left.

STANDARD V.

A. 1. £14 15s. 0½d.
2. £28 7s. 3¾d.
3. £291 5s. 2¼d.
B. 1. £75 19s.
2. £1354 10s.
3. £5 3s. 6½½d.
C. 1. £7 8s. 5d.
2. £3952 13s. 4d.
3. 20.
D. 1. £56 4s. 11½d.
2. £17 3s. 10½d.
3. £7446 3s. 4½d.

E. 1. £11 10s. 0½d.
2. £22 2s. 0¾d.
3. £97,230 19s. 7½d.
F. 1. 17 cwt. 2 qr. 14 lb.
2. £370.
3. £16 12s. 9¼d.

ADVANCED EXAMINATION.

1. £73 3s. 7½d.
2. M. 14s.; w. 10s. 6d.
3. £39 18s. 10½d.

STANDARD VI.

A. 1. $2\frac{1}{4}$.
2. $\frac{1}{12}$.
3. $8\frac{2}{3}$.
B. 1. ·84375.
2. 434·36.
3. ·03359375.
C. 1. 264 shirts.
2. 3½.
3. 6s. 4d.
D. 1. £1200.
2. £4 7s. 9d.
3. £2 7s. 5½d.

E. 1. $213\frac{1}{2}$ days.
2. $5\frac{7}{18}$d.
3. $\frac{1}{3}\frac{1}{1}\frac{7}{3}$ cwt.
F. 1. 145 to 228.
2. $2\frac{1}{3}\frac{1}{3}\frac{3}{3}$.
3. £113 2s. 8¾d.

ADVANCED EXAMINATION.

1. 60 hours.
2. $11\frac{1}{3}\frac{1}{3}$ days.
3. $106\frac{2}{3}$ yards.

STANDARD VII.

A. 1. £35.
2. £19 19s. 9d.
3. 7s. $5\frac{7}{1}\frac{7}{9}$d.
B. 1. £99 4s. 6d.
2. $3\frac{8}{1}\frac{8}{9}$ p. ct.
3. 7s. 4·23d.
C. 1. $13\frac{7}{1}\frac{7}{1}$.
2. £55 10s.
3. £2 11s. 2½d.
D. 1. £758 18s. 6¾d.
2. £64 0s. $9\frac{3}{1}\frac{3}{9}$d.
3. $29\frac{7}{1}\frac{7}{7}$ p. ct.

E. 1. 999,350.
2. £161 12s. 7⅛d.
3. 7⅛ per cent.
F. 1. $4\frac{3}{8}$ per cent.
2. $2\frac{9}{1}\frac{9}{1}\frac{2}{9}$ years.
3. £2 9s. $11\frac{4}{9}$d.

ADVANCED EXAMINATION.

1. £51 increase.
2. £54⅜ per cent.
3. £3 11s. $4\frac{1}{1}\frac{3}{1}\frac{3}{3}$d.

SOLUTIONS OF THE ADVANCED EXAMINATION QUESTIONS IN 'THE SCHOLAR,' FOR FEBRUARY, 1883.

STANDARD IV.

1. £150 + £25 = £175 selling price of the cloth.
£175 ÷ 8s. 9d. = 400 yards. Ans.

2. £50 − £18 17s. 6d. = £31 2s. 6d., *twice* price of foal.
£31 2s. 6d ÷ 2 = £15 11s. 3d. Ans.

3. $48\frac{1}{2}$ yds. × 50 = $2412\frac{1}{2}$ yds. of cloth.
$2412\frac{1}{2}$ yds. = 38600 nls., and 3 yds. 2 qrs. 2 nls. = 58 nls.; then 38600 nls. ÷ 58 nls.
= 665 coats, and 1 yd. 3 qrs. 2 nls. left. Ans.

STANDARD V.

1. John Robinson, Esq.,
To. Wm. Carpenter.

				s.	d.	£	s.	d.
18 bricklayers	each	$4\frac{1}{2}$	days at	5	6 =	22	5	6
13 joiners	,,	$5\frac{1}{4}$	,,	5	2 =	17	12	$7\frac{1}{2}$
9 masons	,,	$3\frac{1}{2}$	,,	5	9 =	9	1	$1\frac{1}{2}$
5 slaters	,,	$6\frac{1}{2}$	,,	6	3 =	10	3	$1\frac{1}{2}$
10 labourers	,,	$7\frac{1}{2}$	,,	3	9 =	14	1	3
						£73	3	$7\frac{1}{2}$ Ans.

Paid Feb. 3rd, 1883. Wm. Carpenter. (N.B.—A penny stamp required.)

2. 3s. 6d. × 80 = £14 excess received by men. Then £87 10s. − £14 = £73 10s. to be *equally* divided among the (80 m. + 60 w. =) 140 persons. Hence £73 10s. ÷ 140
= 10s. 6d. a woman's share. Ans.
And 10s. 6d. + 3s. 6d. = 14s., a man's share. Ans.

3. £1 5s. $11\frac{1}{2}$d. ÷ 15 = 1s. $8\frac{1}{4}$d. per qr. = 6s. 11d. a yard.
6s. 11d. × $115\frac{1}{2}$ = £39 18s. $10\frac{1}{2}$d. Ans.

STANDARD VI.

1. $\frac{1}{1}\frac{1}{0} - \frac{1}{1}\frac{1}{1} = \frac{1}{1}\frac{1}{0}$ fraction of the work done by D in *one* hour, hence he would be 60 hours in doing the whole. Ans.

2. As 20 men = 25 women, a woman eats $\frac{4}{5}$ of what a man does, hence $\frac{4}{5}$ of 30 = 24 the equivalent in men of the 30 women. Then 40 + 24 = 64 men. Then by proportion,
$$\frac{15\text{d.} \times 20\text{m.} \times 500\text{st.}}{64 \times 200} = 11\frac{7}{1}\frac{1}{6} \text{ days.}$$ Ans.

3. ·85 of 2·2 cr. = 1·87 cr. = £·4675 cost per yd.
£·655 − £·4675 = £·1875 = 3s. 9d. gain per yard, and £20 ÷ 3s. 9d. = $106\frac{2}{3}$ yards. Ans.

STANDARD VII.

1. 84 (No. of hundreds) × 3 = £252 annual income from the 3 per cents. £101 × 84 = 8484 cash received on selling out. £8484 ÷ £140 = $60\frac{3}{5}$ cents. of stock bought. £5 × $60\frac{3}{5}$ = £303 annual income from the 5 per cent. stock. Then £303 − £252
= £51 increase. Ans.

2. At 3s. 6d. the skates that cost £100 sell for £135, and as 4s. is $\frac{8}{7}$ of 3s. 6d., then $\frac{8}{7}$ of £135 = £$154\frac{2}{7}$, the excess of which over £100, that is £$54\frac{2}{7}$, is the gain per cent. Ans.

3. 120 days = $\frac{1}{3}\frac{2}{6}\frac{0}{5} = \frac{2}{7}\frac{4}{3}$ of a year; $\frac{2}{7}\frac{4}{3}$ of £4 = £$1\frac{2}{7}\frac{4}{3}$ interest on £100 for 120 days. Hence £100 would amount to £$101\frac{2}{7}\frac{4}{3}$, consequently the discount is $\frac{1\frac{2}{7}\frac{4}{3}}{101\frac{2}{7}\frac{4}{3}} = \frac{2}{7}\frac{4}{3}\frac{4}{3} = 1\frac{2}{8}\frac{4}{9}$ of the given sum of money; then $1\frac{2}{8}\frac{4}{9}$ of £275 = £3 11s. $4\frac{1}{8}\frac{3}{9}\frac{3}{9}$d. Ans.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE LITTLE LEARNER,' FOR FEBRUARY, 1883.

STANDARD I.

A. (1) 288
(2) 132
(3) 198
B. (1) 1,895
(2) 1,884
(3) 1,246
C. (1) 2,620
(2) 1,035
(3) 1,630
D. (1) 123
(2) 555
(3) 146
E. (1) 404
(2) 333
(3) 619
F. (1) 66
(2) 177
(3) 657
G. (1) 31,251
(2) 14,820
(3) 13,033
H. (1) 3,983
(2) 79
(3) 5,573
I. (1) 166
(2) 35,304,025
(3) 26 years
J. (1) 2,454,184,212
(2) 114
(3) 3,036 houses

STANDARD II.

A. (1) 320,994
(2) 103,648
(3) 134,034
B. (1) 7,656
(2) 29,889
(3) 88,496
C. (1) 595,672
(2) 411,708
(3) 834,444
D. (1) 3,222,540
(2) 4,696,800
(3) 6,146,376
E. (1) 14,683,184
(2) 40,284,671
(3) 455,827,400
F. (1) 6,349
(2) 9,450+1
(3) 16,059
G. (1) 12,173+2
(2) 9,789
(3) 5,888+5
H. (1) 2,948+2
(2) 8,576
(3) 6,989+10
I. (1) 45,354,730
(2) 156 times
(3) 769 sheep; 606 sheep
J. (1) 6s. 7d.; 7s. 11d.; 9s. 10d.
(2) 43 nuts
(3) 895 marbles

STANDARD III.

A. (1) 2,538
(2) 965+7
(3) 1,900+29
B. (1) 4,708
(2) 7,059
(3) 10,454+78
C. (1) 30,405
(2) 8,970
(3) 9,997+46
D. (1) 3,807+917
(2) 6,007
(3) 10,126+6,554
E. (1) £212 17s. 5d.
(2) £327 18s. 1¾d.
(3) £1,712 11s. 4½d.
F. (1) £29,553 0s. 1½d.
(2) £16,795 4s. 6¾d.
(3) £77,150 3s. 2d.
G. (1) £307 17s. 8d.
(2) £6 5s. 10¾d.
(3) £913 12s. 10½d.
H. (1) £1,517 12s. 6¾d.
(2) £568 14s. 10¼d.
(3) £9,000 19s. 11½d.
I. (1) 785 books
(2) £2 17s. 11½d.
(3) £1 18s. 11½d.
J (1) 1,293,183 halfpence
(2) 8,090 times
(3) 14 days

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR FEBRUARY, 1883.

EXERCISE XV.

(1) 42. (2) 72. (3) 7. (4) 180. (5) 112. (6) 32 years. (7) 40, 60. (8) 24, 36. (9) 15 marbles. (10) 41, 19. (11) 80 sheep. (12) 36 feet. (13) Tom 20, Dick 64, and Harry 86 marbles. (14) 21. (15) 1224 and 1791 votes. (16) 1s. 3d. and 6s. 3d.

—o—

The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

FOR the first time in the history of national education, a grant is to be given *direct*, for the teaching of elementary science. *Indirectly*, this subject has received pecuniary encouragement ever since there has been a system of national education. I remember, when a pupil teacher, some thirty years ago, that the head-master of the school, Mr. Colin Russell Roberts, was a very enthusiastic teacher of science, and especially of 'social science,' a subject that then received considerable attention. As a result of this teaching, there was an amount of manly intelligence and sharpness about the boys that I have seldom seen equalled. The inspector, Mr. Matthew Arnold, set a very high estimate upon these results. Good reports and good grants followed accordingly. Here, then, was a payment made indirectly for the teaching of elementary science. At that time, we did not call the subject by this name, we called it 'object-teaching.' But afterwards there came a code. Particular subjects were now paid for in a *direct* manner, and general intelligence, in a very *indirect* manner. In fact, so 'indirectly' that, to some minds, it did not appear to have any value at all set upon it; so it often passed into the background. Nevertheless, some few teachers have since this time continued to teach elementary science, believing in its efficacy as an educative power. The 'grant indirect' has not indeed always followed so 'accordingly' as it did before. Still, these few educationalists have not been discouraged; for there have always been some inspectors, who, having formed a true and noble conception of what it is to educate a child, do not in their reports lightly pass over the honest endeavours of teachers to cultivate intelligence and manliness among their scholars.

Now, however, there is to be an improvement. The Government, feeling that of late the instruction in elementary schools has grown to be somewhat mechanical, has framed a code which is intended to remedy such defect. It is sought to infuse a little of *soul* into our teaching by giving encouragement to various efforts for developing the intellectual capabilities of the children. Here, then, is a great move onwards. No one will find fault with this advance, even should it be discovered that the first stage in it is to take a step backwards some thirty years and revive something that then existed. Of course I do not mean to say that the teaching of elementary science is the only way of securing intellectual growth; for any subject taught intelligently will do so, more or less; but I firmly believe that 'science-teaching' will attain this end better than any other subject. And I assume the Education Department entertains a similar view, and has therefore introduced it as a class-subject. The School Board for London seems to have arrived at the same conclusion; for, by a recent circular, it has insisted that elementary science shall be taught in all Metropolitan schools. I observe, further, that some members appear to be even anxious to revive the almost forgotten subject, 'Social Science.'

It is, therefore, quite clear that elementary science is henceforth to occupy an important place in the curriculum of our primary schools. I purpose in these articles, 1st, to submit a detailed syllabus of a year's course of lessons in this subject for each standard; 2nd, to give the entire subject-matter for each lesson; and, 3rd, to illustrate my methods of teaching by reproducing a few lessons actually given. In short, it is my intention, that these articles shall form a complete text-book of matter and method.

For our guide as to what shall be taught, we have, 1st, the syllabus of the Education Department, and, 2nd, the circular issued by the London School Board. In the former it is stated that for Standard I. 'there shall be given a progressive course of simple lessons on common objects, such as familiar animals, plants, and substances employed in ordinary life,' such lessons to aim at the cultivation of 'habits of exact observation, statement, and reasoning.' In the latter, teachers are instructed to extend 'the object lessons in the Infant School, with simple illustrative experiments.' This is all the official information we have, so far as Standard I. is concerned, and I may add, all we need. The main purpose of this teaching is well stated in the Code, as being nothing less than the cultivation of *habits* of exact observation, exact statement, and exact reasoning. Now, if we are going to form *habits*

at all, the earlier we begin the better: hence the wisdon of starting with Standard I. If this process of 'habit-forming' be continued systematically throughout the school, we may hope that a Seventh Standard child will at least begin to observe, state, and reason, with exactitude. And that he will do this with a minimum of effort, for this is what *habit* implies.

The following is a syllabus for a year's course of lessons for Standard I.

PART I.—THINGS IN OUR HOUSES.

(*a*) FOOD.

1. *Food*, generally: why we eat and drink.
2. *Bread:* different kinds of corn: wheat, barley, oats.
3. *Meat:* Sheep, cow, fish, poultry.
4. *Drinks:* Water, milk, tea, coffee, beer.
5. *Vegetables:* Cabbages, turnips, carrots, peas, beans.
6. *Fruits:* Apples, pears, oranges, plums, currants.

(*b*) DRESS.

1. Dress, generally: Why we dress.
2. Cotton, wool, linen, silk, leather.

(*c*) FURNITURE.

1. *Articles of wood:* (*a*) of pine, (*b*) of mahogany, (*c*) of hard wood.
2. *Articles of iron:* Fire-place, cast-iron; poker, etc., wrought iron; knives, etc., steel.
3. *Articles of glass:* Windows, glasses, looking-glass; outlines of glass-making.

(*d*). MONEY.

1. *Money, generally.* Meaning of money, why used.
2. *Coins.* Gold coins, silver and bronze: shells as money.
3 *Bank notes.* Meaning of a bank note.

PART II.—THINGS IN THE STREETS.

(*a*) STONES.

1. *Stones of the pavement, i.e.*, sandstones.
2. *Stones of the kerb* and road, *i.e.*, granite.
3. *Stones of the houses, i.e.*, limestone.

(*b*) GAS AND LIGHTING.

1. How gas is made.
2. Other ways of lighting.

(*c*) CARRIAGES.

1. Cabs, omnibuses, tram-cars, use of laying *rails.*

PART III.—THINGS IN THE SCHOOL.

(*a*) BOOKS.

1. *Old style* of *writing* books—*i.e.*, on skins, bark, etc.
2. *Printing* and paper.

(*b*) SLATE and CHALK.

(*c*) INK.

(*d*) COAL.

PART IV.—OTHER COMMON THINGS.

(*a*) Common wild plants.

1. Buttercup, daisy, primrose, bluebell.
2. Poisonous wild plants.

(*b*) Common trees.

1. The lime-tree, its peculiar flowers; how to tell a lime-tree.
2. The fir; its wood; how to tell a fir-tree.
3. The elm, chestnut.

(*c*) Common animals that work for us.

1. Horse, camel, reindeer, elephant—*i.e.*, beasts of burden.
2. Silkworms, bees, coral animal.

PART V.—MISCELLANEOUS SUBJECTS.

(*a*) HEALTH.

1. Fresh air, meaning and use.
2. Clean bodies and clean clothes.
3. Happy disposition, how formed.
4. Proper food.

(*b*) WATER.

1. General properties of water.
2. Water on the land: oceans, seas, lakes, rivers.
3. Water in the air: clouds, dew, rain, hail, snow, and hoar-frost.

(*c*) AIR.

1. General properties of air.
2. Pressure of the air.
3. Dense and rare air, or thick and thin air, balloons.

This syllabus embraces a course of about forty lessons. If two are given per week the whole syllabus may be gone over twice in the course of the year. In the first half-year the instruction will be exceedingly elementary. In all cases, specimens should if possible be shown, and simple experiments performed. In the next article I will reproduce a lesson given to my first standard on 'Food Generally; why we Eat and Drink.'

—o—

Correspondence.

23, Field Street, Bloxwich,
January 12th, 1883.

To the Editor of the PRACTICAL TEACHER.

DEAR SIR,—Kindly insert in your next issue of the PRACTICAL TEACHER the enclosed, for benefit of Mr. Martin and other readers of the PRACTICAL TEACHER. The question will be found on page 554 of January number.

And oblige,
Yours truly,
H. WALKER.

GRAMMATICAL QUESTIONS.

First year's Grammar for Pupil Teachers' Examination, July 29th, 'Flow softly down,' etc. Tennyson's 'A Farewell.' Second year's, 'Take warning,' etc. Tennyson's 'The Blackbird.'

First year's, November 25th, 'Not wholly in the living world,' etc. Tennyson's 'Gardener's Daughter,' lines 34-43.

Third year, November 25th, 'And now farewell,' etc. Tennyson's 'Morte D'Arthur' (near the end).

The cheapest volume of Tennyson's poems is that published by Kegan Paul and Co., London, price 6s.

Query Column.

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. POOL.—How many lbs. of tobacco at 5s. 8d. a lb. must be mixed with 4 lbs. at 6s. 6d., so that the mixture may be sold at 7s. 10d. a lb., and $33\frac{1}{3}$ per cent. gained on the outlay?

£ s. d. £
$133\frac{1}{3}$: 7 10 :: 1 0 0 : Cost price of mixture
3 3
400 | 23 6
5 10½

Difference between cost price of mixture and first kind
= 5s. 10½d. − 5s. 8d.
= 2½d.
Difference between cost price of mixture and second kind
= 6s. 6d. − 5s. 10½d.
= 7½d.
∴ Quantity of 1st kind : Quantity of 2nd kind
:: 7½d. : 2½d.
:: 15 : 5
:: 3 : 1.
∴ There must be 12 lbs. at 5s 8d. to 4 lbs. at 6s. 6d. Ans.

2. M. G.—Find the true discount on £457 18s., drawn September 12th at 5 months, at 4 per cent.? Bill is due on February 15th.

No. of days from September 12th to February 15th
= 156.
$\frac{156}{365}$ of £4 = £$\frac{624}{365}$ = £1 $\frac{259}{365}$.
£ £ s. £
∴ 101 $\frac{259}{365}$: 457 18 :: 1 $\frac{259}{365}$: Discount
365 20 365
9281 9158 156
156
54948
45790
9158
9281)1428648(153s.
9281
50054
46405
36498
27843
8655
12
103860(11d.
9281
11050
9281
1769

∴ Discount = £7 13s. 11 $\frac{1769}{9281}$d. Ans.

3. BILL AND WILLIE.—I bought 128 yards of cloth for £100, and am now forced to sell it at a loss of as much money as I shall receive for 12 yards. At what price per yard am I selling it?

As the cloth is sold at a loss of as much money as is received for 12 yards,
∴ Selling price per yard = £100 ÷ (128 + 12)
= £100 ÷ 140
= £$\frac{5}{7}$
= 14s. 3$\frac{3}{7}$d. Ans.

4. LOUIE.—Simplify :—

$(\frac{1}{10}$ of $3\frac{1}{4}) + (\frac{3}{8} \div \frac{27}{64}) - \left(\frac{1}{1\frac{1}{7}} - \frac{1\frac{1}{2}}{3}\right) \div (2 - \frac{5}{8})$.—(*Barnard Smith.*)

$$(\tfrac{1}{10} \text{ of } 3\tfrac{1}{4}) + (\tfrac{3}{8} \div \tfrac{27}{64}) - \left(\frac{1}{1\frac{1}{7}} - \frac{1\frac{1}{2}}{3}\right) \div (2 - \tfrac{5}{8})$$

$$= \left(\frac{1}{\cancel{10}_{2}} \text{of} \frac{\cancel{13}}{4}\right) + \left(\frac{\cancel{3}}{\cancel{8}} \times \frac{\cancel{64}^{8}}{\cancel{27}_{9}}\right) - \left(\frac{1}{\frac{8}{7}} - \frac{\frac{3}{2}}{\frac{3}{1}}\right) \div 1\tfrac{5}{8}$$

$$= \tfrac{1}{8} + \tfrac{8}{9} - (\tfrac{7}{8} - \tfrac{4}{8}) \div 1\tfrac{5}{8}$$

$$= \frac{9+64}{72} - \frac{63-32}{72} \div 1\tfrac{5}{8}$$

$$= \tfrac{73}{72} - \frac{31}{\cancel{72}_{8}} \times \frac{\cancel{9}}{13}$$

$$= \tfrac{73}{72} - \tfrac{31}{104}$$

$$= \frac{949-279}{936}$$

$$= \tfrac{670}{936}$$

$$= \tfrac{335}{468}.$$ Ans.

5. GLENERY.—(1) $\frac{1}{10} - \frac{1}{2} \times \frac{1}{5} = \frac{1}{10} - \frac{1}{10}$.

(2) $\frac{1}{2} - \frac{1}{4} \div \frac{1}{8} = \frac{1}{2} - \frac{1}{\cancel{4}_{1}} \times \frac{\cancel{8}^{2}}{1} = \frac{1}{2} - 2$.

(3) $\frac{1}{2} \div \frac{1}{8} - \frac{1}{4} = \frac{1}{\cancel{2}_{1}} \times \frac{\cancel{8}^{4}}{1} - \frac{1}{4} = 4 - \frac{1}{4}$.

(4) $\frac{1}{2} \div \frac{1}{4} \times \frac{1}{8} = \frac{1}{2} \times \frac{\cancel{4}}{1} \times \frac{1}{\cancel{8}_{2}} = \frac{1}{4}$.

(5) $\frac{1}{2} \times \frac{1}{4} \div \frac{1}{8} = \frac{1}{2} \times \frac{1}{4} \times \frac{8}{1} = 1$.

Rule.—When quantities have to be added or subtracted, simplify first those connected by the multiplication or division sign with another quantity, before performing the addition or subtraction. For example (1), (2), and (3), and see No. 4 Query in Arithmetic from Barnard Smith.

When quantities are connected by the multiplication and division signs only, perform the operations in order.

Quantities connected by '*of*' must always be taken together.

Note.—Elliot's 'Mensuration' is published by Hughes.

6. DAMON AND PYTHIAS.—If a person invest £25,350 in the 3 per cents. at 92⅝, at what price must he sell out after receiving the dividend to make a profit of £250? (*Brooke Smith.*)

£ £ £
$92\frac{1}{2} : 25{,}350 :: 1\frac{1}{2}$: Half-yearly dividend

$$= \frac{\cancel{25350} \times 3 \times \cancel{2}}{\cancel{185} \times \cancel{2}} \text{£}$$

$$= \text{£}\frac{2850}{19}$$

$$= \underline{\text{£}410\frac{10}{19}}.$$

Sum lost on selling out $= \text{£}410\frac{10}{19} - \text{£}250$

$$= \text{£}160\frac{10}{19}.$$

£ £ £
$\therefore 25{,}350 : 92\frac{1}{2} :: 160\frac{10}{19}$: Decrease in price of stock

$$= \frac{\cancel{19} \times \cancel{2000} \times 8 \times \cancel{19}}{\cancel{25350} \times \cancel{2}} \text{£}$$

$$= \underline{\text{£}\frac{832}{13}}.$$

$\therefore$ Selling price $= \text{£}92\frac{1}{2} - \text{£}\frac{832}{13}$

$$= \underline{\text{£}92\frac{1}{26}}. \text{ Ans.}$$

7. H. GOODHEAD.—The first-class fare on a railway is $1\frac{3}{10}$ times the second-class fare, and it is found that 140 first-class, 250 second-class, and 520 third-class passengers can go 24 miles for £124. But because of a Government duty all fares are raised 5 per cent., and then 240 first-class, 120 second-class, and 1080 third-class passengers can travel 120 miles for £945. What was the original third-class fare per mile? (*Excise, May, 1882.*)

Before duty is levied,

$(140 \times 1\frac{3}{10} + 250)$ original second-class fares $+ 520$ original third-class fares $= \text{£}\frac{1344}{55}$ per mile,

$\therefore$ 432 original second-class fares $+ 520$ original third-class fares $= \text{£}\frac{24}{55}$ per mile. (1)

After duty is levied,

$(240 \times 1\frac{3}{10} + 120)$ second-class fares $+ 1080$ third-class fares $= \text{£}\frac{3444}{55}$ per mile,

432 second-class fares $+ 1080$ third-class fares $= \text{£}\frac{63}{55}$ per mile,

$\therefore$ 432 original second-class fares $+ 1080$ original third-class fares $= \text{£}\left(\frac{63}{55} \times \frac{21}{20}\right)$ per mile,

$= \text{£}\frac{189}{220}$ per mile. (2)

Subtracting (1) from (2),

$(1080 - 520)$ original third-class fares $= \text{£}\left(\frac{189}{220} - \frac{24}{55}\right)$ per mile,

560 original third-class fares $= \text{£}\frac{7}{220}$ per mile,

$\therefore$ Original third-class fare per mile

$$= \text{£}\left(\frac{7}{3} \times \frac{1}{\cancel{80}\,80}\right)$$

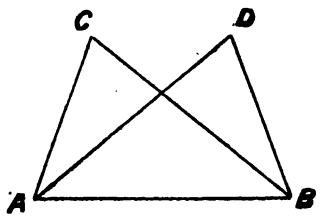
$$= \text{£}\frac{1}{240}$$

$$= \underline{1\text{d.}} \text{ Ans.}$$

NOTE.—There is great room for improvement in your writing.

Geometry.

1. NAGROM.—Given three points in the circumference of a circle, required to find a fourth.



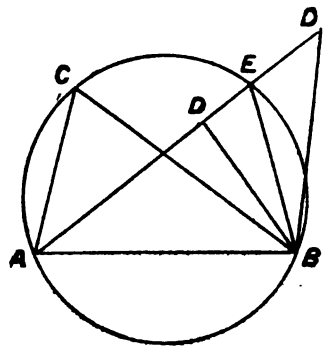
Let A, B, C be the three given points in the circumference, it is required to find a fourth.

Join AB, BC, CA.

At the point A make the angle BAD equal to the angle ABC, and at the point B make the angle ABD equal to the angle BAC. (I. 23.)

Then the point D is the fourth point in the circumference of the circle.

PROOF.—If the circle be described passing through A, B, C, it will also pass through D; if it do not pass through D, then the point D must fall either within or without the circumference.



If possible, let AD or AD produced cut the circumference in E. Join EB.

Then the angle AEB = the angle ACB; (III. 21.)

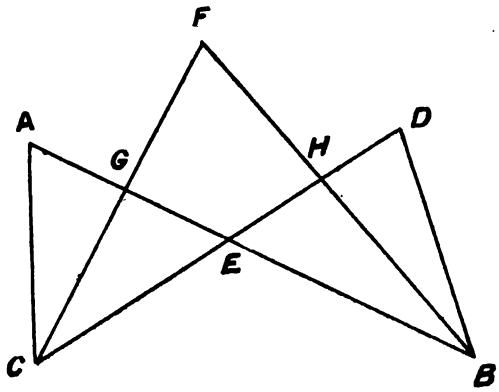
But ,, ,, ADB = ,, ,, ,, ; (I. 32.)

$\therefore$,, ,, AEB = ,, ,, ADB; (Ax. 1.)

But this is impossible; (I. 16.)

$\therefore$ the point D is in the circumference. Q. E. F.

2. ANXIOUS.—AEB, CED are two straight lines intersecting at E; straight lines AC, DB are drawn forming two triangles ACE, BED; the angles ACE, DBE are bisected by the straight lines CF, BF, meeting in F. Show that the angle CFB is equal to half the sum of the angles EAC, EDB. (*Todhunter.*)



PROOF.—Angle CGB = angles CFB, FBE, (I. 32.)

and ,, ,, = ,, EAC, ACF, ,,

$\therefore$ Angles CFB, FBE = angles EAC, ACF.

Again, angle BHC = angles CFB, FCE,

and ,, ,, = ,, EDB, DBF,

$\therefore$ Angles CFB, FCE = angles EDB, DBF.

Wherefore, twice angle CFB + angles FBE, FCE

= angles EAC, EDB, ACF, DBF;

but, angle FBE = angle DBF,

and ,, FCE = ,, ACF,

$\therefore$ Twice angle CFB = angles EAC, EDB, (Ax. 3.)

Wherefore angle CFB is equal to half the sum of the angles EAC, EDB.

Q. E. D.

3. TRURON.—ABC is an equilateral triangle. On AB take any distance AF, on BC take BD equal to AF, and on CA take CE equal to AF. Join AD, BE, and CF. Show that these three lines either meet in one point, or enclose an equilateral triangle.

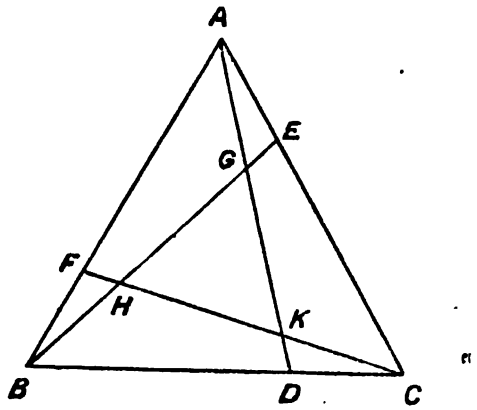
PROOF.—In the triangles ABE, CAD,

the two sides BA, AE = the two sides AC, CD, each to each,

and the angle BAE = the angle ACD (I. V. Cor.)

$\therefore$ the triangles are equal in all respects, (I. 4.)

wherefore angle ABE = angle CAD.



The angle HGK=angles GBA, BAG, (I. 32.) but the angle GBA has been proved to be equal to the angle CAD,

$\therefore$ angle HGK=angles CAD, BAD,

=angle BAC.

Similarly the angle GHK can be proved equal to the angle ABC, and the angle GKH to the angle ACB;

Therefore the triangle HGK is equiangular; wherefore it is equilateral. (I. VI. Cor.)

NOTE.—When the distances are half the sides, the three lines meet in one point. (See deduction in our issue for October, 1882.)

Algebra.

1. INQUISITIVE.—Simplify—

(1) $\dfrac{p^2+q^2+r^2+2(qr+rp+pq)}{p^2-(q^2+r^2+2qr)}$,

(2) $\dfrac{3p^3-16p^2+23p-6}{2p^3-11p^2+17p-6}$

(*Edinburgh University Local Examination*, 1882.)

(1) $\dfrac{p^2+q^2+r^2+2(qr+rp+pq)}{p^2-(q^2+r^2+2qr)}$

$=\dfrac{(p+q+r)^2}{p^2-(q+r)^2}$

$=\dfrac{(p+q+r)^2}{(p+q+r)(p-q-r)}$

$=\underline{\dfrac{p+q+r}{p-q-r}}$. Ans.

(2)

$$\begin{array}{r} 3 \\ 2p^3-11p^2+17p-6 \overline{)\,6p^3-32p^2+46p-12} \\ \underline{6p^3-33p^2+51p-18} \\ p^2-5p+6 \end{array}$$

$$\begin{array}{r} 2p-1 \\ p^2-5p+6 \overline{)\,2p^3-11p^2+17p-6} \\ \underline{2p^3-10p^2+12p} \\ -p^2+5p-6 \\ \underline{-p^2+5p-6} \end{array}$$

$\therefore \dfrac{3p^3-16p^2+23p-6}{2p^3-11p^2+17p-6}$

$=\underline{\dfrac{3p-1}{2p-1}}$. Ans.

2. A. B.—A person has 200 coins, consisting of guineas, half-sovereigns, and half-crowns: the sums of money in guineas, half-sovereigns, and half-crowns are as 14 : 8 : 3; find the number of the different coins.

Let x = no. of guineas,

y = ,, half-sovereigns,

and z = ,, half-crowns;

then $21x$ = value of guineas in shillings,

$10y$ = ,, half-sovereigns in shillings,

and $\frac{5z}{2}$ = ,, half-crowns in shillings.

$\therefore 21x : 10y :: 14 : 8$

$21x : 10y :: 7 : 4$

$3x : 5y :: 1 : 2$

$5y = 6x$

$\therefore y = \underline{\dfrac{6x}{5}}$

$\therefore 21x : \frac{5z}{2} :: 14 : 3$

$21x : 5z :: 7 : 3$

$3x : 5z :: 1 : 3$

$5z = 9x$

$\therefore z = \underline{\dfrac{9x}{5}}$.

But, $x+y+z = 200$

$\therefore x+\dfrac{6x}{5}+\dfrac{9x}{5} = 200$

$x+\dfrac{15x}{5} = 200$

$4x = 200$

$\therefore \underline{x = 50}$.

$\therefore$ No. of guineas $= \underline{50}$,

,, half-sovereigns $= \frac{6}{5}$ of $50 = \underline{60}$,

,, half-crowns $= \frac{3}{5}$ of $50 = \underline{90}$.

3. IMPRIMATUR.—Solve :—

$$\left.\begin{array}{l} xy = x+y \\ xz = 2(x+z) \\ yz = 3(y+z) \end{array}\right\} \quad (\textit{Colenso.})$$

(1) $xy = x+y$

$xy-y = x$

$(x-1)y = x$

$\therefore \underline{y = \dfrac{x}{x-1}}$.

(2) $xz = 2(x+z)$

$xz-2z = 2x$

$(x-2)z = 2x$

$\therefore \underline{z = \dfrac{2x}{x-2}}$.

(3) $yz = 3(y+z)$

$\dfrac{x}{x-1}\times\dfrac{2x}{x-2} = 3\left(\dfrac{x}{x-1}+\dfrac{2x}{x-2}\right)$

$\dfrac{2x^2}{(x-1)(x-2)} = \dfrac{3(x^2-2x+2x^2-2x)}{(x-1)(x-2)}$

$2x^2 = 3(3x^2-4x)$

$= 9x^2-12x$

$7x^2 = 12x$

$7x = 12$

$\therefore \underline{x = 1\tfrac{5}{7}}$.

$y = \dfrac{x}{x-1} = \dfrac{\frac{12}{7}}{\frac{5}{7}} = 2\tfrac{2}{5}$,

And $z = \dfrac{2x}{x-2} = \dfrac{\frac{24}{7}}{-\frac{2}{7}} = \underline{-12}$.

4. E. E. H. W.—Three persons can complete a piece of work in 60 days; and it was found that the first does three-fourths of what the second does, and the second four-fifths of what the third does; in what time can each alone complete the work?

Let x = part done by third,

Then $\dfrac{4x}{5}$ = ,, ,, second,

And $\frac{3}{4}$ of $\dfrac{4x}{5}$ or $\dfrac{3x}{5}$ = ,, ,, first;

$\therefore x+\dfrac{4x}{5}+\dfrac{3x}{5} = 1$

$12x = 5$

$\therefore \underline{x = \tfrac{5}{12}}$.

Part done by third in 60 days $= \frac{5}{12}$,
" " " 1 day $= \frac{1}{60}$ of $\frac{5}{12}$
$= \frac{1}{144}$;
" " second in 60 days $= \frac{6}{7}$ of $\frac{7}{12}$
$= \frac{1}{2}$,
" " " 1 day $= \frac{1}{120}$;
" " first in 60 days $= \frac{7}{8}$ of $\frac{7}{12}$
$= \frac{1}{4}$,
" " " 1 day $= \frac{1}{240}$.

∴ First can do the work in 240 days, second in 180 days, and third in 144 days.

Note.—The 1st day of June, 1851, fell on Sunday.

5. PEVERIL.—A person drew a quantity of wine from a full vessel, which held 81 gallons, and then filled up the vessel. He then drew from the mixture as much as he before drew of pure wine, and it was found that 64 gallons of pure wine remained. Find how much he drew each time. (*Todhunter.*)

Let x = quantity drawn out each time,
Then $81 - x$ = " of pure wine remaining after first time,
And $\frac{x}{81}$ of $(81 - x)$ = " " taken second time;

$$\therefore x + \frac{x(81-x)}{81} = 17$$
$$81x + 81x - x^2 = 1377$$
$$x^2 - 162x = -1377$$
$$x^2 - 162x + (81)^2 = 6561 - 1377$$
$$= 5184$$
$$x - 81 = \pm 72$$
$$x = \pm 72 + 81$$
$$\therefore x = 153 \text{ or } 9.$$

The value 153 is inapplicable.

∴ Quantity drawn each time = 9 gallons.

Note.—Writing pretty good, but it would be greatly improved if the *t's* were not crossed, and the capitals devoid of flourishes.

Mensuration.

1. BIRDIE.—Seven men bought a grinding-stone of 60 inches in diameter; each paying $\frac{1}{7}$th part of the expense, what part of the diameter must each grind down for his share?

Circles are to one another as the squares of their diameters.

(Diameter of circle − diameter of 1st part)^2 $= \frac{1}{7}$ of (60 in.)^2
$= \frac{21600}{7}$ sq. in.

Diameter of circle − diameter of 1st part $= \sqrt{\frac{21600}{7}}$ in.
$= \sqrt{\frac{21600 \times 7}{7 \times 7}}$ in.
$= \frac{\sqrt{151200}}{7}$ in.
$= \frac{388{\cdot}8444}{7}$ in.
$= 55{\cdot}5492$ in.

∴ Diameter of 1st part $= (60 - 55{\cdot}5492)$ in.
$= 4{\cdot}4508$ in.

(Diameter of circle − diameter of 1st and 2nd parts)^2
$= \frac{2}{7}$ of (60 in.)^2
$= \frac{126000}{7}$ sq. in.

Diameter of circle − diameter of 1st and 2nd parts
$= \frac{\sqrt{126000}}{7}$ in.
$= \frac{354{\cdot}9647}{7}$ in.
$= 50{\cdot}7092$ in.

∴ Diameter of 2nd part $= (55{\cdot}5492 - 50{\cdot}7092)$ in.
$= 4{\cdot}84$ in.

(Diameter of circle − diameter of 1st, 2nd, and 3rd parts)
$= \frac{3}{7}$ of (60 in.)^2
$= \frac{108000}{7}$ sq. in.

Diameter of circle − diameter of 1st, 2nd, and 3rd parts
$= \frac{\sqrt{100800}}{7}$ in.
$= \frac{317{\cdot}4901}{7}$ in.
$= 45{\cdot}3557$ in.

∴ Diameter of 3rd part $= (50{\cdot}7092 - 45{\cdot}3557)$ in.
$= 5{\cdot}3535$ in.

(Diameter of circle − diameter of 1st, 2nd, 3rd, and 4th parts)^2
$= \frac{4}{7}$ of (60 in.)^2
$= \frac{144000}{7}$ sq. in.

Diameter of circle − diameter of 1st, 2nd, 3rd, and 4th parts
$= \frac{\sqrt{75600}}{7}$ in.
$= \frac{274{\cdot}9545}{7}$ in.
$= 39{\cdot}2792$ in.

∴ Diameter of 4th part $= (45{\cdot}3557 - 39{\cdot}2792)$ in.
$= 6{\cdot}0765$ in.

(Diameter of circle − diameter of 1st, 2nd, 3rd, 4th, and 5th parts)^2
$= \frac{5}{7}$ of (60 in.)^2
$= \frac{180000}{7}$ sq. in.

Diameter of circle − diameter of 1st, 2nd, 3rd, 4th, and 5th parts
$= \frac{\sqrt{50400}}{7}$ in.
$= \frac{224{\cdot}4994}{7}$ in.
$= 32{\cdot}0713$ in.

∴ Diameter of 5th part $= (39{\cdot}2792 - 32{\cdot}0713)$ in.
$= 7{\cdot}2079$ in.

(Diameter of circle − diameter of 1st, 2nd, 3rd, 4th, 5th, and 6th parts)^2
$= \frac{6}{7}$ of (60 in.)^2
$= \frac{216000}{7}$ sq. in.

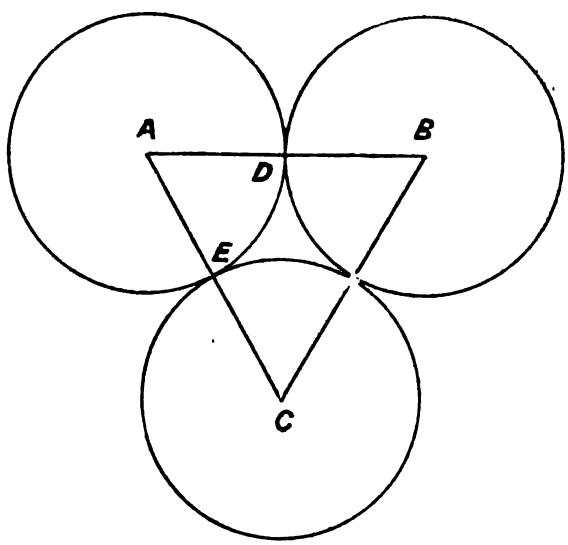
Diameter of circle − diameter of 1st, 2nd, 3rd, 4th, 5th, and 6th parts
$= \frac{\sqrt{25200}}{7}$ in.
$= \frac{158{\cdot}745}{7}$ in.
$= 22{\cdot}6778$ in.

∴ Diameter of 6th part $= (32{\cdot}0713 - 22{\cdot}6778)$ in.
$= 9{\cdot}3935$ in.

Diameter of 7th part = diameter of circle − diameter of 1st, 2nd, 3rd, 4th, 5th, and 6th parts;

∴ Diameter of 7th part $= 22{\cdot}6778$ in.

2. J. EDWARDS.—Three equal circles, each 10 inches in diameter, touch one another externally; find the area of the space included between them. (*Excise, November*, 1879.)



Area of space between the circles = area of equilateral triangle ABC − 3 times area of sector ADE
= area of an equilateral triangle of side 10 inches − 3 times ($\frac{1}{2}$ area of circle of diameter 10 inches)
$= (\cdot 433 \times 10^2)$ sq. in. $- (\frac{1}{2} \times 10^2 \times \cdot 7854)$ sq. in.
$= 43{\cdot}3$ sq. in. $- 39{\cdot}27$ sq. in.
$= 4{\cdot}03$ sq. in. Ans

NOTE.—Writing pretty fair.

3. JOHN HALIFAX.—Find the diameter of a circle which is less than the circumference by 10 feet.

Circumference = Diameter × $3\frac{1}{7}$ (nearly).

When the diameter is 1 foot, the circumference is $3\frac{1}{7}$ feet.

∴ When the diameter is 1 foot, it is less than the circumference by $2\frac{1}{7}$ feet.

$$\therefore \text{ Diameter} = \frac{10}{2\frac{1}{7}} \text{ feet}$$
$$= \frac{70}{15} \text{ ,,}$$
$$= \frac{14}{3} \text{ ,,}$$
$$= 4\tfrac{2}{3} \text{ feet. Ans.}$$

General.

1. W. T. D. and A. J. T.—(1) *I know*, princ. sent.; *I*, subject; *know*, predicate; *when he died*, subordinate noun sentence, objective to *know*; *when*, connective; *he*, subject; *died*, predicate. (2) The second sentence is analysed in a similar way, except that *when he died* is a subordinate adjective sentence in adjectival relation to *time*.

2. CYMBRO BACH.—(*a*) *Master*, nominative of address or vocative, extra sentential. *Who*, subject; *did*, predicate; *this*, object. (*b*) *As long as I am in the world*, subordinate adverbial sentence to *I am the light of the world*. *As long as*, connective; *I*, subject; *am in the world*, predicate; (*c*) *Go, wash in the Pool of Siloam*. (*Thou*), subject; *go*, predicate. (*Thou*), subject; *wash*, predicate; *in the Pool of Siloam*, adverbial adjunct. (*d*) *He went his way therefore*. *He*, subject; *went*, predicate; *his way*, object (cognate); *therefore*, adverbial adjunct. (*e*) *That he was blind*, noun sent. in objective relation to *seen*. The verb *seen* has also a redundant object in *him*.

3. H. R. OGDEN.—The *third* (of the chord) major or minor regulates the chord, *i.e.*, makes it major or minor. In (1) the F sharp is 4 semitones above (1) the tonic or key-note; and this F sharp is thus a *major third* from D. If the F had been left natural it would have been only 3 semitones above D, and the chord would have been *minor*. For the same reason (2), G being 3 semitones only above E is *minor*, and makes the chord also *minor*, The same applies to (3) B flat, being but 3 semitones above G. Had B been left natural the chord would have been *major*. (4) Is either copied wrong or *indefinite*, the third (E), the regulating interval, being omitted. In (5) the full chord is given with the major third; in (6) with the minor third, E flat.

4. ASHBURTON.—Your question cannot be solved by arithmetic, and the process by Algebra is so very complicated and lengthy, that we cannot give the time nor space for its solution. We will, however, show you a method of solution, so that you can work it out for yourself.

If x = an annual payment in pounds,

Then, $12x = 1{,}050 + \frac{1}{10}(1{,}050 - x) +$

$$\frac{1}{10}\left\{1{,}050 - 2x + \frac{1050 - x}{20}\right\} +$$

$$\frac{1}{10}\left\{1{,}050 - 3x + \frac{1050 - 2x + \frac{1050 - x}{20}}{20} + \right.$$

$$\left. \frac{1050 - x}{20}\right\} + \ldots .$$

This is to the end of fourth year, and if you proceed similarly to the end of twelfth year, you will form the equation.

5. J. G.—The answer to the question (Fourth Year, PRACTICAL TEACHER, Examination Paper, July, 1882) should be 675 square feet.

6. T. D.—The meaning is simply that £20 shares are worth £25, and therefore shares for £100 are worth £25 × 5 or £125.

7. J. M. W.—The answer should be given in English money, not French. He receives 400 francs for his debt, but the value of those francs is only £16, and therefore his loss is 5s.

8. SMUT.—No.

9. Q.—The class has been abandoned, and the Examination Questions (with Model Ans.) to various university and other examinations substituted.

10. N.B.—We have made enquiries for you, but can find no announcement of 'The Analytical Classical Series,' other than that issued by Messrs. Simpkin and Co.

11. AGAMEMNON.—*Mr. Francon Williams'* 'Geography of the Oceans.' Published at 2s. 6d. Any bookseller can get it for you.

12. RALPHO.—The Code has not changed on the point you name.

13. VILLAGE T.—It would be impossible (within the limits of space assigned us) to recommend books for all subjects. Consult your nearest certificated teacher. If you want advice on one or two special subjects we shall be happy to help you.

14. SEMPER FIDELIS.—Yes, Battersea is a CHURCH Training College. The secretary would doubtless give you any information you want. Early in our next volume we hope to publish full particulars of all the training colleges for the convenience of our readers.

15. ROMEO.—*Ichth* is the first syllable of a Greek word meaning fish.

16. G. W. R.—(*a*) No; not unless the remainder of the term is at least equal to two years; (*b*) see advertisements in daily papers for situation you would like.

17. MUSA.—(*a*) Cassell's 'Educational Year Book' would be of service, but see our answer to *Semper Fidelis*; (*b*) try Morris's or Mason's. Both are excellent.

18. DON'T KNOW.—She might be employed in present school as assistant; or improve herself by private study. The entrance fee varies with the college. Say what college you intend her to enter. See answer to *Semper Fidelis*.

19. CYMRO.—(*a*) Hughes's, published by Philip and Son, Fleet Street, or Dr. Morrison's, or Dr. Clyde's. See advertisements. (*b*) Sutton's or Hullah's. One of the special features of our next volume will be *Music for Students*, which will embrace the whole subject.

20. HABEAS CORP.—History, Curtis's; Grammar, Morell's or Mason's; Geography, Philip's. Read our advertisement columns carefully and you will easily find what you want.

21. BON SOIR.—No; it is not possible. Your writing is excellent.

22. E. T. R.—Write to Mr. Jennings, Tuition by Correspondence Office, Deptford, London.

23. FIDES.—(1) *Etiquette*: small book published at *Family Herald* office, also by Messrs. Ward, Lock and Co., Salisbury Square, Fleet Street, E.C. *Water-colour Painting*, Aaron Birley's and Leitch's. (2) Messrs. Trübner and Co., Ludgate Hill, London, E.C., sell foreign books; also Mr. D. Nutt, Strand, W.C. (3) Mansfield's Euclid, 1s. (Hughes) for a beginner.

24. HIGHAM.—Hullah's 'Time and Tune' (Longmans). Write to Mr. Thomas Murby, 32, Bouverie Street, Fleet Street, E.C., for his catalogue, in which you will find several cheap, well-written and suitable manuals on the subject. See our answer to *Cymro*.

25. HUROCO.—Your translation is very fair, and the alterations we could suggest are too trifling to mention.

26. COOPE.—Since Moses was *not* the son of Pharoah's daughter, it would be more correct to use the subjunctive 'were' instead of the indicative 'was,' in the first line of the passage you quote. The phrase 'the daughter-of-Pharoah' must be counted as one noun in order to make any sense of the passage.

27. CARACTACUS.—A fair idea of analysis can be obtained from the small primer on English grammar published by Macmillan.

28. MECHANICS.—You can hardly do better than get Todhunter's book.

29. F. W. M.—A solid right circular cone of homogeneous iron is 64 inches in height, and its mass is 8,192 lbs. The cone is cut by a plane perpendicular to the axis, so that the mass of the small cone removed is 686 lbs. Find the height of the centre of gravity of the truncated portion remaining above the base of the cone.

Solidity of cone : Solidity of small cone
:: (Height of cone)^3 : (Height of small cone)^3

$\therefore$ 8,192 lbs. : 686 lbs. :: (64 in.)^3 : (Height of small cone)^3

$$\therefore \text{(Height of small cone)}^3 = \frac{\overset{343}{\cancel{686}} \times 64 \times 64 \times 64}{\underset{2}{\cancel{8192}}} \text{ cub. in.}$$

$$= (343 \times 64) \text{ cub. in.}$$

$\therefore$ Height of small cone $= (7 \times 4)$ in.
$= 28$ in.

Centre of Gravity of cone $= \frac{1}{4}$ of height from base
$= \frac{1}{4}$ of 64 in. from base
$= 16$ in. from base;

,, ,, ,, small cone $= \frac{1}{4}$ of its height from its base
$= \frac{1}{4}$ of 28 in. from its base
$= 7$ in. from its base.

Let x = Height of Centre of Gravity of frustrum of cone above the base in inches

Then, $\{(8,192-686)\times x\}+\{686\times(64-28+7)\}=8,192\times 16$

$$7,506x+(686\times 43)=131,072$$
$$3,753x+14,749=65,536$$
$$3,753x=65,536-14,749$$
$$=50,787$$
$$\therefore x=\frac{50787}{3753}$$
$$=13\cdot532\ldots$$

∴ Height of Centre of Gravity of frustrum of cone above the base = 13·532 ... inches.

30. FRENSHAM, Farnham.—Having given the measure f of a certain acceleration with given units l and t of length and time, find the measure of the same acceleration with other given units l' and t'.

In second case, $f=\frac{l}{l'}\cdot\frac{t'^2}{t^2}$

31. 1st B.A., Farnham.—Two bodies A and B move with different accelerations from rest; A moves over $(a+b)$ feet in $(s-t)$ seconds, B moves over $(a-b)$ feet in $(s+t)$ seconds. If the units used are for A the inch and second, and for B the yard and minute, the measures of the accelerations are as 2 to 1, and the whole velocities gained by A and B in the above-mentioned times respectively are as 10 to $\frac{1}{3}$, prove that s is to t as 13 to 11, and a is to b as 43 to 7.

Let f = measure of acceleration of A, taking the foot and second,
Then $12f$ = " " " " inch and second;
Let x = " " B, " foot and second,
Then $\frac{60^2}{3}x$, or $1200x$ = measure of acceleration of B, taking the yard and minute;

$$\therefore 1200x=\tfrac{1}{3}\text{ of }12f$$
$$=6f$$
$$\therefore x=\tfrac{1}{200}f;$$

$v=f(s-t)$, and $v'=\frac{1}{200}f(s+t)$,

$$\therefore f(s-t):\tfrac{1}{200}f(s+t)::10:\tfrac{1}{3}$$
$$s-t:\tfrac{1}{200}(s+t)::50:3$$
$$3(s-t)=\tfrac{1}{2}(s+t)$$
$$12(s-t)=s+t$$
$$11s=13t$$
$$\therefore s:t::13:11.$$

$v^2=2f(a+b)$, and $v'^2=2\times\frac{1}{200}f(a-b)$

$$\therefore 2f(a+b):\tfrac{1}{100}f(a-b)::10^2:(\tfrac{1}{3})^2$$
$$2(a+b):\tfrac{1}{100}(a-b)::100:\tfrac{1}{9}$$
$$\tfrac{1}{50}(a+b)=a-b$$
$$18a+18b=25a-25b$$
$$7a=43b$$
$$\therefore a:b::43:7.$$

32. PRINCE JOHN.—You will find the solution of your query (by arithmetic) in our issue for January, 1882.

33. M. H.—Percentage of child's share remaining after payment of legacy duty = 99, percentage of brother's = 97; product of these two numbers = 9,603. The sum £9,603 is taken for the supposition of the amount received by a brother *to avoid fractions*; of course, any other sum might have been taken.

Do you require any further explanation?

34. F. S.—(1) The answer is correct. You have forgotten to calculate the brokerage on selling out of one stock, and on re-investing in the other. This is distinctly stated in the question.

£81¼ in the former stock produces £3;

Selling price without the brokerage = £81¼ − £¼
= £81¼;

Price of second stock with brokerage = £136¼ + £¼
= £136½;

£ £ £
∴ 136½ : 81¼ :: 3 : Income in 2nd case.

$$\frac{4}{545}\quad\frac{4}{327}$$
$$\frac{}{109}\quad\frac{}{3}$$

= £3.

You will thus see that the income is the same in each case. How is it that you entirely overlooked the statement of brokerage on each transaction?

(2) The *second* method is correct. The *first* method is entirely wrong.

35. T. H. B.—(1) The solution of your query appeared in our issue for April, 1882.

(2) Write to J. Keefe, Esq., F.S.A., Civil Service Academy, 6, Colquitt Street, Liverpool.

36. BAFFLED.—We cannot see the method of solution of your query. Please give the source from which you derived it.

37. COUNTRY TEACHER.—Get the Science Syllabus, where you will find information. Write to Longmans and Macmillans for the catalogues.

38. ROGO.—As the sum of *five* odd members is an odd number, your query is absurd.

39. JENNIE.—You will find the solution of your query in our issue for October, 1882. It is a question in Arithmetical Progression, and it is given among the Algebraical Queries.

40. ARABI PASHA.—When a legal case is taken into *avizdum* it signifies that the sheriff will consider it further before delivering judgment. It is a Scotch law term.

41. ANXIOUS.—If you have not been a pupil-teacher you cannot sit till you are twenty-one.

42. R. P. SMITH.—You do not state for what examinations you want the books. (1) Mansford's (Hughes). Write to Messrs. Longmans and Co., Macmillan and Co., and Mr. John Murray for their catalogues, where you will find admirable manuals on the subjects you name.

43. JARL.—Write to Rev. Edmund Fowle, Amesbury House, Bickley, Kent. He publishes (through the Messrs. Longmans) a series of books that will meet your wishes. The subject will be dealt with in our new volume.

44. K. S.—The papers will appear in our pages, so you will have an opportunity of judging for yourself.

45. A PERPLEXED ONE.—Apply to Mrs. Floyer, Principal of the London Institute for the Advancement of Plain Needlework, who will doubtless be happy to set your mind at rest.

46. THIRD YEAR.—Get the 'Science and Art Directory,' or write to the Secretary of the S. and A. Department, South Kensington.

47. DAMON AND PYTHIAS.—A Latin PRIMER is not sufficient for Scholarship Examination. You will be glad to hear that this subject will be dealt with in our next number. Yes, a syllabus is published. Order it through any bookseller. Your writing is very fair; the capitals, however, are not *round* enough.

48. WILDHEN.—(1) Consult any Geographical Reader for St. I. (2) We have for a long time used an 'Asbestos' stove, particulars of which will be given you by any respectable ironmonger.

49. AURUM LILY.—About March.

50. ED. DONKIN.—You will find the information in the catalogues published by Messrs. Longmans. and Co., and Messrs. Macmillan and Co. Why don't you buy the Directory?

51. H. G. STYLES.—Write to Mr. J. S. Curwen, Tonic Sol-fa Agency, Warwick Lane, Paternoster Row, E.C.

52. A. B.—On the last Saturday in May, but you should communicate with your inspector.

53. STUDENT.—Skakspere's 'Julius Cæsar' and Bacon's 'Essays' will appear with full notes in our own columns. The following books will be used this year in one of the best metropolitan training colleges. Mrs. Fawcett's 'Political Economy,' 'Complete Manual of Teaching' (National Society), Mackay's 'Intermediate Geography,' Bright's History of England, vol. iii. The Messrs. Chambers publish a good Mensuration.

54. WAMBA.—Get a syllabus through your bookseller. It contains all that you want.

55. EXCISEMAN.—Write to Mr. J. Keefe, Colquitt Chambers, Colquitt Street, Liverpool. See also our advertisements.

56. LARS PORSENA.—Buy a syllabus for yourself. The 'marks' are not now published, though they used to be. See article on 'Our Training Colleges' in our next or a very early number.

57. C. K. F.—Yes, but you should read VERY CAREFULLY Art. 66 of the New Code.

58. CONSTANT READER.—

Myself—Reflexive or reciprocal pers. pron., common gen., sing. num., 1st pers., and obj. case governed by trans. verb *strike*.

Years—Common noun, neut. gen., plur., object. — *the objective of time*.

The Practical Teacher.

A MONTHLY EDUCATIONAL JOURNAL.

To Subscribers.—The *Practical Teacher* is published on the 25th of every month. Price 6d.; post free, 7½d.; sent post free, three months for 1s. 11d.; six months, 3s. 9d.; a year, 7s. 6d.

P. O. Orders should be made payable at Chief Office.

Subscribers not receiving their copies regularly are respectfully requested to write to the Publisher.

It would save time and expense if subscribers when remitting would state exactly what numbers they wish to be sent.

To Correspondents.—All literary communications should be addressed, THE EDITOR OF THE PRACTICAL TEACHER, Pilgrim Street, Ludgate Hill, London, E.C.

Accepted contributions are paid for within twenty-one days of publication.

The Editor cannot return rejected MSS.; authors should therefore retain copies.

TO ADVERTISERS.

Approved, *prepaid*, advertisements will be inserted in the *Practical Teacher* at the following rates:—

	s.	d.
20 words or under	3	0
Above 20 words and under 32 words ...	4	0
32 words and under 64 words	5	0
For every additional 10 words	1	0

Teachers Advertising for Situations.

	s.	d.
20 words or under	1	0
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For an ordinary page	4 guineas
For page facing matter	5 guineas.
For 2nd page of wrapper	5 guineas.
For 3rd page of wrapper	5 guineas.
For the page opposite the 3rd page of wrapper	5 guineas.
For the 4th (back) page of wrapper ...	6 guineas.

Parts of a page are charged at a slightly higher rate.—Special quotations will be given for a series.

Portfolios, fitted with elastic bands, for preserving twelve numbers of 'The Practical Teacher,' may now be had. Price 2s. 6d. Orders should be given through booksellers.

Vol. I. of the *Practical Teacher* is now out of print.

Publications Reviewed.

Water, and its Teachings in Chemistry, Physics, and Physiography. A Suggestive Handbook. By C. L. Morgan, F.G.S. London: E. Stanford, 55, Charing Cross.

This is, as it is called, a suggestive handbook, and if well used will be of great value to teachers and others. It takes the form of notes arranged in numbered paragraphs, which notes are intended to supply a framework on which the teacher's instruction shall be founded. The field covered by the notes is a very wide one; the author having tried, as he says in his preface, to 'make the substance (water) illustrate the general principles of inorganic science,' and that these notes should form the 'basis of class instruction in general inorganic science, to run parallel with more special and exact work in chemistry.'

We are thoroughly in sympathy with the plan and principle on which this book is founded. Nothing is more certain than that proceeding from the concrete to the general, is a much safer and more profitable way of teaching than the converse method; and one which commends itself to the youthful mind, as every one must be aware who has tried both plans with a class of young students. Show a boy by some such experiment as that described in paragraph 1,094, how much heat is lost to the thermometer in converting ice into water; and then *deduce* from this and similar experiments your definition of latent heat. His ideas on the subject will be much clearer and more exact than those of the boy whose text-book begins the subject of latent heat with a formal definition of what is meant by the term, and then proceeds to give various illustrations of it.

But although the taking of water, the most universal of material substances, as a peg on which to hang lessons concerning other material substances and forces, is in itself wise, we cannot but think that in this book it is made to teach some things that might have been better taught if some other substances had been chosen.

The arrangement in paragraphs is convenient, especially for reference, but we think that the multiplication of paragraphs has been greatly carried to excess. Thus in the following extract it is difficult to see why the three paragraphs, which form part of one continuous statement should be separated:—

'700. We must now inquire how this (oceanic) circulation is brought about.

'701. The following experiment of Dr. Carpenter shows how, in his opinion, it is caused.

'702. A long tank, with class sides, is filled with water. At one end a piece of ice is wedged in,' etc., etc.

In these days of examinations, it is difficult to see where such a book as this will be accepted as a text-book. It does not conform exactly to the requirements of any examination, and so will doubtless be rejected by very many teachers who have the requirements of examiners or school inspectors before their eyes. But where the master can choose his own syllabus of instruction and wants a text-book which goes in an elementary but scientific and thoroughly accurate manner into the main facts of physical science, he cannot do better than choose the book before us.

It is clearly printed in a large type, and elegantly bound. Although destitute of illustrations, in the hand of a competent teacher who is able to draw fairly well and perform the necessary experiments, this is rather an advantage than otherwise.

Magnetism. By T. P. Treglohan. London: Longmans, Green, and Co.

This is not a book pretending to any originality. It has been written to supply the lack of a text-book for the elementary stage of the Science and Art Department, treating of magnetism under the divisions laid down in the syllabus of the Department.

We have no love for examination text-books, though in this present 'competitive-examination age' they seem to be a necessary evil. They tend to cramp the intellect and convert students into examination-machines. The tendency is to say of all extraneous matter, however interesting and important it may be. 'Oh! that is not required; you need not remember that!' But if special text-books for special examinations are required, the more practical they are made the better; and we are glad to see that at the end of each section of this little book a number of experiments and observations (called

indiscriminately 'experiments') are described, to be performed before the student. The subject is evidently intended to be taught practically as well as theoretically. This feature redeems the book from being a mere collection of definitions and statements as it otherwise would necessarily be. The definitions and statements are clearly made, and the book forms a reliable handbook to the subject of which it treats. The diagrams are well executed, and show the points very well. The book is strongly bound, the stitching, unfortunately, almost encroaching on the printed matter.

Worked Examination Questions in Plane Geometrical Drawing. By T. E. Hulme, F.L.S., F.S.A. London: Longmans, Green, & Co.

The indefatigable Art Master of Marlborough College has, in this latest addition to the list of publications with which his name is already associated, issued a work which will be invaluable to candidates preparing for the Military, the Civil Service, the University Local, or, in fact, for any examination in which a knowledge of plane geometry is required. In this book some 300 problems, selected from the papers set in various examinations and of all degrees of difficulty, are thoroughly worked out. The 'get up' of the publication is excellent, the drawings clear, and the paper and printing all that could be desired. A very good feature is that the diagrams are printed on double pages, which, when unfolded, leave the drawing clear of the book. This is a great boon to the worker, as it relieves him of the worry and annoyance caused by having to constantly turn over page after page when wishing to compare the diagram with the question. Not the least useful part of the book is the preface, in which Mr. Hulme gives many reliable hints to students in this branch of the art.

Electricity. By Robert N. Ferguson, Ph.D. New Edition, revised and extended by James Blyth, M.A., F.R.S. London: W. and R. Chambers.

Although the somewhat laconic title of this excellent little book is in the one word 'Electricity,' that *fidus Achates* Magnetism is considered also, and, with a wisdom that might be followed advantageously by other writers and teachers, is considered first. Perhaps the most useful part of so much of the volume as deals with magnetism is, if we make the comparisons with other works that, *pace* all popular proverbs, are necessary to the critic, the chapter on the chronology of magnetism. The diagrams, without presenting the artistic finish of the more expensive text-books, are the equals of the plates in these latter in the matter of plainness, in its best sense, and accuracy. The units given at the commencement of the work are a wise introduction, whilst the brief but admirably clear chapter on the general principles of dynamics, intercalated in the division of the book that deals with electricity, shows that its author is a good practical teacher. For in dealing with any subject involving a knowledge of certain large fundamental principles that are regarded as pertaining to another branch of knowledge, it is necessary to briefly enumerate those principles, if the work in question is for students. These last younger thinkers will not stop to see if they are familiar with the dynamical principles involved in the study of electricity. They will not pause to verify their presumed knowledge. Hence the practised teacher, with a laudable desire to prevent his readers from floundering hopelessly ere many pages are traversed because they have not taken the trouble to assure themselves as to their knowledge of the meaning of unit-force or trinetic energy, takes the trouble for them, as all good teachers must, and briefly recapitulates the necessary dynamical principles.

A trace of carelessness in the English—or shall we say the British?—language is visible here and there, and more than once or twice terms are used that are only explained on subsequent pages, or not explained at all. The Fahrenheit scale is unfortunately used in the earlier part of the book, though in the later pages it is supplanted by its more worthy companion. In the account of the Holz machine, on page 126, it is to be regretted that the letter E is used for any part of the apparatus, as the author also uses that letter for the word 'electricity' in his description; hence much possibility of confusion on the part of the student. It may be open to question also whether more might not advantageously be said as to the chemistry of the Faure's and Planté's cells, after the excellent discussion on these two forms of battery by Professor J. H. Gladstone, Dr. Tribe, and Dr. Oliver J. Lodge.

But these are only minor blemishes in a work of considerable excellence. That it is level with the most recent advances of electrical science is among its least merits. The photophone and the nomenclature adopted by the International Congress of Electricians at Paris in October of last year are explained in this volume. Some of the explanations are of a rare clearness; notably those that deal with lines of force, with the magnetic field, with the action of the horizontal and vertical constituents of the earth's magnetic force, and with the *vexata questio* of potential. To this last we only take exception on the ground that the analogy of potential with temperature, the best as we think of analogies in this difficult conception, is ignored. From the mathematical side the work is well done. In fact, it is at once a recommendation and a drawback to the book that the treatment of the subject is so largely mathematical—a recommendation because the only rational investigation of magnetic and electrical phenomena must be on a mathematical basis; a drawback in that so few of our physical students bring to their study the essential pre-requisite of an average mathematical training. It is on this ground, and on this ground alone, that we fear only one half of the aim of its author has been attained. He would have his treatise popular and accurate. Accurate it assuredly is. We fear it may not be as popular as it is accurate. But, after all, accuracy is the better half.

A Manual of Greek Verbs. By F. Ritchie, M.A., and E. H. Moore, M.A. London: Rivingtons.

In the preface to this little book the authors state that in it an attempt has been made to arrange in a clear and consecutive order the laws which govern the inflexion of the Greek verb, to supply copious examples of their application, and to collect and group the chief instances of irregularity. They are to be congratulated that the outcome of their labours is the production of a text-book which will be welcomed alike by both teacher and scholar. The book is thoroughly fitted for school use, being both serviceably bound and clearly printed, with every assistance that diversity of type can give to the user, and although, of necessity, in a work on such a subject no great scope is afforded for originality, yet whatever there is in it fresh in the way of arrangement and grouping is judicious and well carried out.

Songs. 'Jo,' 'A Souvenir of Bleak House,' and 'Twilight Memories.' Words and music by Noretta. London: B. Williams, 60, Paternoster Row; each 2s., net.

These songs will add little to the reputation of a firm which has published many really good things. Both words and music of the first suggest their theme only by their poverty. Indeed, the entire song reads like a poor exercise in verbal and musical composition, done without feeling, and with small experience in the use of either vehicle of expression. College men would possibly be ludicrously reminded of the fractional ellipses in some unfortunate 'Criticism Lesson,' by the bisection of 'pau-per' (sic.), by a quaver rest; this, by-the-bye, is a passage marked *tristement*. 'Twilight Memories' is somewhat better. That 'In the Gloaming' is suggested some may deem fortunate; and that the three short verses have each the same setting, while, in both songs, the melody is throughout repeated in the accompaniment, may be considered advantages by any who require but little work and considerable assistance.

English Grammar. By F. A. White, B.A. London: Kegan Paul, Trench, and Co.

Mr. White has here given us an interesting book which, though not in our opinion adapted for school use, will well repay the student for perusal. The author's mode of treating his subject varies considerably from that pursued in most grammars, and though we cannot agree with his views in all cases, we cordially admit that they are stamped with no small amount of originality and learning. In the preface Mr. White states that throughout the book he has made the English language *as it is* the primary consideration, and that, instead of drawing illustrations from the forms occurring in English *as it was*, he has assumed the knowledge of a little Latin and French on the part of his readers, and has drawn his illustrations from those languages. We think this principle a sound and useful one, and wish it had been carried out even to a greater extent than in the little book before us. A grammar compiled in this way would be more likely to prove beneficial to school-boys than one bristling with Anglo-Saxon, Icelandic, and Old English forms (which, however useful they may be to the *student*, only confuse the *young learner*, and the more so, since the mode of spelling these forms varies in different text-books), if only from the fact that the three languages, when so treated, mutually aid one another, and the boy, while pursuing one language, insensibly widens his knowledge of the other two. In looking more critically into Mr. White's book we note the occurrence of many words which, though not met with in most treatises, it is just as well the student should know. The terms 'agglutinative,' 'grammatology,' 'hyperdissyllable,' 'procopê,' 'anuric,' 'onomatopœic,' 'orthopœic,' 'guillemets,' 'monoids,' are a few of these. The force and originality which characterize the author's remarks on some debatable points are likely to prove of service to the student by enabling him to see both sides of the question, and thus prevent him from accepting statements blindly on trust.

Bell's Standard Elocutionist. London: Hodder and Stoughton.

This is a revised, enlarged, and improved edition of an old favourite. When a book has been before the public so long as this, ordinary criticism is needless. Pupil teachers and others will find an abundance of excellent pieces suitable for recitation.

A Treatise on Hydromechanics. Part I. Hydrostatics. By W. H. Besant, M.A., F.R.S. London: Deighton, Bell, and Co.

A comparison of this volume of very recent issue with its predecessors is not uninteresting, as showing the gradual advance in our knowledge and in our treatment of any given branch of science. Mr. W. H. Besant first issued in 1859 a treatise on Hydrostatics and Hydromechanics. The table of contents of the 250 pages of this volume makes no recognition of the two main divisions of Hydromechanics, although the letter-press of the book deals with these two subjects in definite sequence. In 1867, a second edition of 291 pages appeared, the two divisions of the subject being clearly marked off in the table of contents. In 1877, the title of the third edition is the inclusive one of Hydromechanics, and the book extends to 320 pages. And now in 1883, Mr. Besant has to publish his work in two volumes, the first of which, on fluids in equilibrium, comprising 228 pages, is before us. A book that has stood the test of twenty-four years needs little recommendation. Nevertheless, it is at once a duty and a pleasure to say that this new edition surpasses, were that possible, its fellows in clearness and in accuracy. As far as we have been able to investigate, no error of any kind seems to have intruded itself, and all the old charm of Mr. Besant's treatment of mathematics is as noticeable as ever. The admirable series of exercises, many of them original, and all excellently typical and thoughtful, is amplified. In pursuance of his usual plan, the author gives none of the solutions, and in that fact we find the only matter for regret. The book will be of highest service, not alone to Mr. Besant's own pupils, but to all anxious to make acquaintance with the mathematics of fluids through an introduction at the hands of one of our most accomplished mathematicians.

Shakspere's 'King Richard II.' With Notes. (Blackie's School Classics.) London: Blackie and Son.

This is in every respect an excellent little book, well adapted for school use by its clear print and simple arrangement. The text of the play is preceded by a short introduction, descriptive of that part of English history with which the plot is connected, and the notes, which are capital in their way, being concise and carefully compiled, are placed at the end of the book. The omission of Aumerle (afterwards Rutland), son of the Duke of York, from the genealogical table is probably an oversight.

The Imperial Drawing Books. London: Thomas Murby.

This is a well-arranged and well-brought-out series, and is likely to prove useful for both school and home work. It consists of three books, the first two providing material for training in class and for individual work, and the third containing a series of tests for ascertaining what progress the pupil has made. The paper used is much above the average, and the examples, which number twenty-four in the book now before us (the first of the series), are extremely well drawn and clearly printed. The directions appended to each figure or copy will prove very serviceable to those without a master, and, in fact, impart far more information than the drawing master can as a rule find time to give.

(1) **Illustrated Readings in Holy Scripture: The Life of Christ.** (2) **Bible Cartoons.** London: Wesleyan Methodist Sunday School Union.

These consist of a series of cartoons of considerable size, suitable for hanging on the walls of Sunday and other schools, and only need to be known to be appreciated. The drawings are the work of Mr. W. Gunston, an artist of no mean merit, as the forcible pose and grouping of the figures throughout the whole series abundantly testify. Effectiveness is given to the designs by the employment of a monochrome background, in the case of the Bible Cartoons, gilt; in the others, a neutral *tint*. The figures, lined in on a ground of a light terra-cotta colour, are by this means shown up in a very striking manner.

Imperial Chart of the World on Mercator's Projection. Edinburgh and London: W. and A. K. Johnston.

Too much importance can hardly be attached to the use of Mercator's Projection in teaching geography, for not only is it the most convenient map on which to give simple lessons in latitude and longitude, but also it is the only map on which the track of a ship, always steering the same course, appears as a straight line, and on which the position of places, with respect to each other, is the same as on the globe itself. The specimen of this chart now before us is an excellent production; it is well and clearly printed, and the tints employed (of which the register is perfect), without being so heavy as to interfere with the legibility of the names, are decided enough for all purposes of distinction. The names inserted appear to have been carefully selected to embrace all the most important places on the earth's surface which could be mentioned in a map of the size without sacrificing legibility.

Reference Chart for English Parsing and Analysis. Compiled by R. W. Hinton, B.A. Manchester and London: John Heywood.

This chart is clearly printed in white on a black ground, and since the arrangement is good and the schemes of

parsing and analysis easy to be understood, is likely to prove of great service to the teacher. Mr. Hinton, the compiler, is the headmaster of the Haberdashers' Company's school at Hoxton, and has evidently carried out in this wall-sheet the plan he has found by experience to be most advisable. We have ourselves found a chart of this description most useful in class work, especially in dealing with children in whom, to speak phrenologically, the bump of locality is strongly developed. In the minds of such children a fact or statement may very often be fixed merely by the memory of its position in reference to others on the blackboard or chart.

The Lord's Prayer. Illuminated in colours. Edinburgh and London: W. and A. K. Johnston.

This is a splendid example of what chromo-lithography can do when applied to illumination. The design, worked out in gold, silver, and colours, is bold and effective, and at the same time elaborate in detail. We know of no more fitting ornament for the walls of nursery or bedroom than this 'Our Lord's Prayer.'

Notes.

ON our title-page we have the pleasure to publish the prospectus of our new volume, which we think bids fair to be the best of the three. We have made several important changes in the bill of fare, and hope the feast as now set forth will be to the taste of our guests.

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A word of counsel to our young friends:—Prove yourselves worthy trenchermen when you come to the dishes containing Mr. Capel's Latin Lessons and Dr. Newsholme's Physiology, and may good *digestion* wait on appetite. Years hence, when rejoicing in the mature strength of manhood, you will thank us for the hint.

***

Two important alterations have been made in the rules connected with our Query Column,—the one is, that the real name and address of the writer must be written on a SEPARATE piece of paper, and the pseudonym put at the end of the query; and the other, that no query can be answered in the following issue unless it reaches our office on THE 12TH INSTANT. We have altered the date with a view to reply to *every* query sent, so as not to disappoint our readers. If a query is held over, the sender may rest assured that there is a valid reason for the delay.

***

We desire to draw our friends' attention to another prospectus, that of the *Governess*, which faces the third page of wrapper. This journal is now issued as a *penny weekly*, and, though primarily designed for schoolmistresses, will prove a valuable help to all engaged in teaching. Many of the articles are from the pens of well-known teachers of the ripest experience.

***

An effort has been made to send a copy to every schoolmistress in the kingdom, and if by any mishap any of our readers have not received their copies, we shall be happy to send others upon receipt of a post-card bearing the address.

***

Teachers would be doing us good service by showing the paper to their colleagues and assistants, many of whom would doubtless be glad to 'take in' the *Governess* if they only knew its character.

Publications Received.

Arithmetic—
(1) The National Arithmetic. Standards I. to VII. National Society.
(2) Answers to Four Rules of Arithmetic. Longmans.
(3) Ellery's Course of Arithmetic. Standards III. and IV. With Book of Answers. Chambers.

Elocution—
(1) Bell's Standard Elocutionist (Revised). Hodder and Stoughton.

English Literature—
(1) Merchant of Venice. Bell and Sons.
(2) Julius Cæsar. Bell and Sons.

Euclid—
(1) Euclid Sheets. Relfe Bros.

Foreign Classics—
(1) Picciola. Part X. B. Saintine. G. Bell and Sons.

Grammar—
(1) The National Grammar. Standards II., III., IV. and V. National Society.

History—
(1) The French Revolution, 1789-1795. By E. M. Gardiner. Longmans.
(2) A Concise English History. By Lupton. Longmans.
(3) Historical Ballads. Parts I. and II. National Society.

Latin—
(1) Selections for Latin Prose Composition. By R. M. Millington. Longmans.

Maps, Diagrams, etc.
(1) Chart of the World. A. Johnston.
(2) The Lord's Prayer. A. Johnston.
(3) Reference Chart for English Parsing and Analysis. Mounted on Rollers. John Heywood.
(4) A Series of Penny Outline Maps. Longmans.

Mensuration—
(1) Mensuration for Beginners and Answers. Murby.

Mental Arithmetic—
(1) The Pupil's Mental Arithmetic. Blackie and Son.

Miscellaneous—
(1) The Old Waggon; or, the Old Life and the New. John Heywood.
(2) The Stage in the Drawing-room. Griffith and Farran.
(3) The Work of a Sunday School Superintendent. National Society.
(4) A Pamphlet on Moral Education. John Groom.
(5) The English Constitution. By S. Amos. Longmans.
(6) China Painting Made Easy. John Heywood.

Music—
(1) Twilight Memories. By Noretta. B. Williams.
(2) A Souvenir of Bleak House 'Jo'. By Noretta. B. Williams.

Periodicals and Magazines—
(1) Amateur Work. Part XIV. Ward, Lock, and Co.
(2) Longman's Magazine. No. 3. Longmans.
(3) Cassell's Book of Sports and Pastimes. Part X. Cassell and Co.
(4) Universal Instructor. Part XXVII. Ward, Lock, and Co.
(5) Our Little Ones. Vol. III. No. 3. Griffith and Farran.

Poetry—
(1) Poetry for Standards. Standards I. to VII. Griffith and Farran.
(2) New National Poetry Cards. Standards I., II., III. and IV. National Society.

Readers—
(1) Graduated Readers. Book III. Chambers.
(2) The World at Home. Standard I. Nelson and Sons.
(3) History Readers. No. 1. Marcus Ward and Co.
(4) History Readers. No. 2. Marcus Ward and Co.
(5) Geography Reading Books. Standards I., II., and V. National Society.
(6) Botany Reading Books. Part II. National Society.
(7) Geographical Reader. No. 3. Blackie and Son.
(8) Standard Reading Book. No. 5. Burns and Oates.
(9) Geographical Reader. No. 5. Blackie and Son.

Science—
(1) 'Text-Books of Science'—Physical Optics. Longmans.

Scripture—
(1) Murby's Scripture Manuals—Genesis. Murby.
(2) Notes of Lessons on our Lord's Life and Teaching. National Society.

Certificate Examination, 1882.

MALE AND FEMALE CANDIDATES.

FIRST YEAR.

Grammar and Composition.

Three hours allowed for this paper.

No candidate may omit the exercise in composition or in parsing, or attempt more than one of the sections (A) and (B).

Composition.

Write a brief essay on one of the following subjects :—

1. The neighbourhood with which you are best acquainted.
2. Newspapers.
3. An account of any remarkable invention or discovery of recent times.
4. Intellectual pleasures.

1. For lovers of the picturesque, as represented by hill and dale, wood and water, breezy upland and craggy heights, there is no district in this country which can compare with that of the Peak in Derbyshire. The Pennine Range, which, stretching from the Cheviots to the middle of Derbyshire, has hitherto shown only bare rounded heights, now assumes a more interesting form. Its peaks become more precipitous, while many are covered with huge plantations of fir, and those not so adorned have a rich mantle of the purple heather, which possesses such a charm for all lovers of nature. The hills abound in natural and artificial caverns; the streams—the Wye and the Derwent—are famous for their fish, and find their way through most enchanting scenery, the crags sometimes narrowing the bed of the rivers, so as to convey the idea of mountain gorges or American canons rather than that of quiet rivers.

Mineral springs of different kinds are very plentiful, and the towns which have arisen round them are famous as health resorts, Buxton, Matlock, and Matlock Bath ranking among the most frequented and fashionable inland watering-places. Castleton, with its Peveril Castle and subterranean caverns, has been embalmed in fiction by Sir Walter Scott, while Cromford will ever be noted as the place of, refuge chosen by Richard Arkwright, the cotton spinner, after his retreat from Preston. Good roads, suitable either for pedestrians, bicyclists, or vehicular traffic, intersect the whole district, and every visitor will come away impressed with the beauty, the grandeur, and the variety of this most interesting part of the country.

2. Newpapers play a very important part in the economy of our nation. It is almost impossible to over-estimate the influence they have upon the social and political condition of the people. This will readily be granted when it is remembered that there are nearly two thousand daily and weekly papers published in this country, and that their yearly circulation is estimated at no less than a thousand millions. Their growth has more than kept pace with the increase of population. At the close of the Stewart period there was nothing like our modern newspaper. The only paper allowed was the *London Gazette*, a two-paged sheet of very meagre contents, and published but twice a week. The *News Letter*, an epistle written in London, was the chief means of spreading information in the country, and when it is remembered that many persons were subscribers to each copy, it will easily be seen how meagre such information was. But the growth of the country, the spread of education, and the increase of facilities for communication between different localities, especially during the present century, altered the condition of things amazingly. The union of towns quickened the interest of the people in each other, and awakened the thirst for news. First weekly papers sufficed, but upon the abolition of the tax on paper, and then that upon newspapers themselves, daily editions were imperatively demanded. The price of nearly all papers was reduced to a penny, and so placed within the reach of every individual in the country, with the results already referred to. With the circulation of a thousand million copies annually, it must be apparent that they will exert a great influence upon the thoughts, the opinions, and actions of the inhabitants of this enterprising nation.

(*To be continued.*)

928
14

BY THE REV. EDMUND FOWLE.

SIXPENNY
SCRIPTURE MANUALS.

I.
A SHORT BIBLE HISTORY,
FOR SCHOOLS AND FAMILIES.

II.
THE WANDERINGS OF THE ISRAELITES,
Settlement in Canaan, Government by Judges, etc.
Life of Saul, David, and Solomon.

III.
THE KINGS OF JUDAH AND ISRAEL.
In Parallel Columns.

IV.
SHORT PAPERS ON JEWISH HISTORY.
Giving in connected form the times after the Capitivity down to the destruction of Jerusalem.

V.
THE LIFE OF CHRIST.
In Six separate Parts.
Especially useful for reading at Family Prayer.
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